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U.S. Army Toxic and Hazardous Materials Agency

**Tooele Army Depot -  
South Area**

**Known Releases**

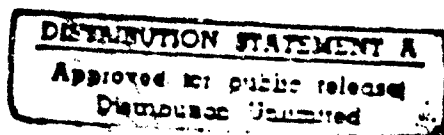
RCRA Facility Investigation  
Phase I

Final  
Summary Report  
30 March 1990

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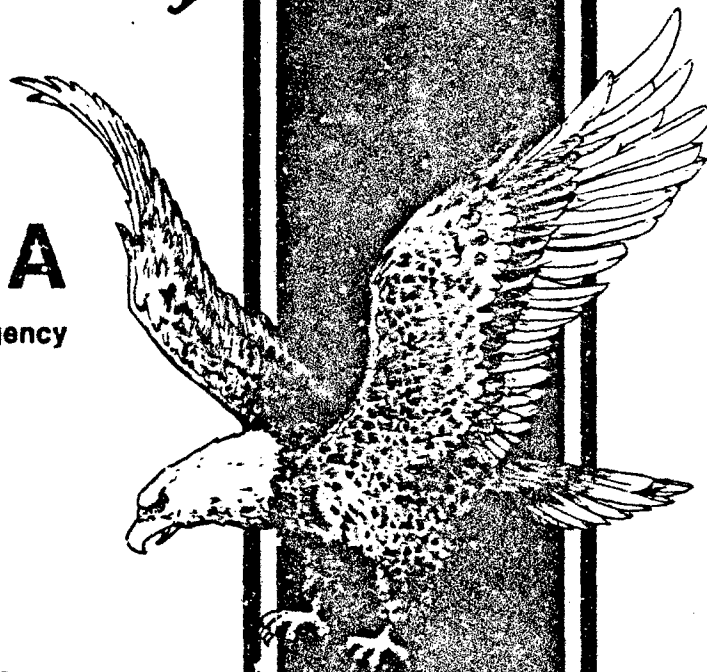
Contract No. DAAA15-88-D-0004

Prepared for:  
U.S. Army Toxic and Hazardous Materials Agency  
Aberdeen Proving Ground  
Maryland 21010-5401



Prepared by:  
**Donohue**  
Donohue & Associates  
Sheboygan, Wisconsin

20030210228



# USATHAMA

U. S. Army Toxic and Hazardous Materials Agency

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## REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY N/A			3. DISTRIBUTION/AVAILABILITY OF REPORT	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A				
4. PERFORMING ORGANIZATION REPORT NUMBER(S)			5. MONITORING ORGANIZATION REPORT NUMBER(S) CETHA-IR-CR-90010	
6a. NAME OF PERFORMING ORGANIZATION EBASCO		6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION USATHAMA	
6c. ADDRESS (City, State, and ZIP Code) 2111 Wilson Boulevard, Suite 1000 Arlington, VA 22201-2627			7b. ADDRESS (City, State, and ZIP Code) AMXTH-IR-D/Bldg. E 4435 Aberdeen Proving Ground, MD 21010-5401	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION USATHAMA		8b. OFFICE SYMBOL (If applicable) CETH-IR-D	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code) AMXTH-IR-D/Bldg e 4435 Aberdeen Proving Ground, MD 21010-5401			10. SOURCE OF FUNDING NUMBERS	
			PROGRAM ELEMENT NO.	PROJECT NO.
			TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) RCRA Facility Investigation Phase I Summary Report for Known Releases Units, Tooele Army Depot - South Area				
12. PERSONAL AUTHOR(S) Jerald Gers, Vanessa A. Harris, Jose-Maria Merino (Donohue and Associates, Inc.)				
13a. TYPE OF REPORT FINAL		13b. TIME COVERED FROM 8/89 TO 3/90		15. PAGE COUNT 107
14. DATE OF REPORT (Year, Month, Day) 1990, 3, 27				
16. SUPPLEMENTARY NOTATION				
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	RCRA, RCRA Facility Investigation, RFI, Solid Waste Management Unit (SWMU), Known Releases, CAMDS, Deactivation Furnace.	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) An RFI Phase I Summary Report was prepared to summarize information regarding solid waste management units (SWMU)s with known releases at the Tooele Army Depot—South Area in Utah. These SWMUs are the Chemical Agent Munitions Disposal System (CAMDS), and the area in the vicinity of the inactive Deactivation Furnace. CAMDS is designed to treat new equipment for demilitarizing many different types of chemical munitions. Waste and product spills have been noted at CAMDS; these include releases at the boiler blowdown ditch and ponding area, the three diesel oil above-ground tanks, and the underground fuel oil product lines. The inactive deactivation furnace served as a prototype of the CAMDS facility by disposing of fuses, first-fire mixes, primers, and small arms. A mercury spill and fuel oil spill were reported to have occurred in this area. Environmental Impacts due to the reported spills are summarized in the report.				
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL Mary Ellen Heppner			22b. TELEPHONE (Include Area Code) (301) 671-3460	22c. OFFICE SYMBOL CETHA-IR-D

RCRA Facility Investigation Phase I Summary Report  
For Known Releases Units  
Tooele Army Depot - South Area  
Tooele, Utah

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## EXECUTIVE SUMMARY

A Research Conservation and Recovery Act (RCRA) Facility Investigation Phase I Summary Report was prepared to summarize information regarding solid waste management units (SWMUs) with known releases at the Tooele Army Depot--South Area (S-TEAD) in Utah. These SWMUs are the Chemical Agent Munitions Disposal System (CAMDS) and the area in the vicinity of the inactive Deactivation Furnace.

S-TEAD is one of three physically separated areas at the TEAD complex; the other two areas are North TEAD and Hill Air Force Base Rail Shops. S-TEAD is located in north central Utah; it is situated in Rush Valley and is bounded on the west by the Stansburg Mountains, on the east by the Oquirrh Mountains, and on the north by South Mountain and the Stockton Bar. S-TEAD comprises an area of approximately 19,400 acres.

S-TEAD has a semi-arid/cold desert climate characterized by hot, dry summers and cold winters. Prevailing winds are from the south during summer months and from the north during winter months. Annual precipitation is 10 to 12 inches per year. The regional geology of Rush Valley is characterized by major faulting which has produced a zone of trenches, elongated plateaus and ranges. The soils in S-TEAD consist of two surficial types: 1) colluvium and alluvium deposits with high permeability; and 2) lake bed sediments with a low to moderate permeability. Underlying the unconsolidated deposits are limestone and sandstone of Mississippian age. Rush Valley is part of a large interior drainage basin, the Great Salt Lake Basin. Drainage from Rush Valley flows northwest across the southwestern portion of S-TEAD. The groundwater flow system occurs generally under unconfined conditions with local areas of semiconfined conditions. The depth to water ranges from less than 10 feet in the southwest corner to 300 feet in the northeast corner. A groundwater divide is present across the site which runs to the northeast, extending from the southwest corner of S-TEAD to the South Area Laboratory. The general groundwater flow velocity is estimated at 4 to 24 feet/year and in a westerly-southwesterly direction.

CAMDS has been in operation since 1979 conducting research into the development of various methods of demilitarizing lethal chemical munitions and treating the wastes resulting from demilitarization processes. CAMDS is designed to test new equipment and new methods for demilitarizing many different types of chemical munitions; as a result, the plant was designed to be flexible enough to use different flow schemes and equipment. The methods of destroying the various munitions include incineration of agents, incineration of residual agent contamination on metal parts and inert munition components, and incineration of explosive components.

Waste and product spills have been noted at CAMDS. The primary releases were noted at the boiler blowdown discharge ditch and ponding area, the three diesel oil above-ground tanks, and the underground fuel oil product lines. Numerous other reported spills have occurred at CAMDS. These include a spill of sodium hydroxide in the new materials area, a spill of potassium dichromate at the 3X yard, and releases of organic chemicals from the Sample Analysis Facility. Semivolatile and volatile organic compounds as well as explosives, inorganic compounds, and radionuclides have been found in soil and groundwater. Explosives have also been found in site surface water. Exposure of S-TEAD personnel to chemicals of potential concern in surface water, sediments, subsurface soil and groundwater by ingestion or direct contact is unlikely because there is no use of these media. On-site inhalation exposures as a result of wind erosion are likely to be low. Soil contamination at the site may be impacting vegetation. It is difficult to thoroughly evaluate vegetation impacts because the extent of surface soil contamination is not completely known. Sage grouse, blacktailed jackrabbit and mule deer do not appear at increased risk of adverse impacts from drinking surface water at CAMDS. In addition, aquatic life in surface waters does not appear to be at increased risk because concentrations of chemicals of potential concern are below their respective aquatic toxicity values. Off-site residential exposures are unlikely. The area is intended as a low density zone with limited human habitation, public utility and service requirements. Off-site wildlife may be exposed to chemicals of potential concern in surface soils, surface water via ingestion, dermal absorption or inhalation. However, qualification of receptor-specific exposures is limited by the lack of appropriate exposure assessment data.

The Deactivation Furnace is located in the north-central portion of S-TEAD. The purpose of the deactivation furnace was to serve as a prototype of the CAMDS facility by disposing of fuses, first-fire mixes, primers, and small arms. From 1976 to 1982, experimental disposal tests were conducted. The tests were not successful and the operations were aborted. The deactivation furnace was dismantled; the equipment was removed from the building and placed on the ground approximately 400 feet northeast of the building. The residual ash material was decontaminated and removed from the site. A mercury spill and a fuel oil spill have occurred in this area. In the area of the mercury spill, chemical analysis of soil samples showed that mercury ranged from below detection limits to 8,600 ug/g. In the area where the fuel spill had occurred, soil samples showed petroleum hydrocarbon concentrations of 480 to 28,000 ug/g. Explosives analysis indicated the presence of nitrobenzene. No human exposure pathways exist under current land-use conditions on-site because the Deactivation Furnace area is not currently used by S-TEAD personnel. Future workers could be exposed to volatile mercury through inhalation. Contaminated surface and subsurface soils of this area could be a potential source of future groundwater contamination. Vegetation impacts could result from direct uptake of mercury, nitrobenzene and petroleum hydrocarbons or from contact through spills or windblown deposition. Wildlife impacts could result from ingestion, inhalation, or direct contact.

## 1.0 INTRODUCTION

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Phase I summary report was prepared to summarize information regarding solid waste management units (SWMUs) with known releases at the Tooele Army Depot -- South Area (S-TEAD) in Utah. These SWMUs are the Chemical Agent Munitions Disposal System (CAMDS) and the mercury contamination area in the vicinity of the inactive Deactivation Furnace. Mercury contamination was not associated with the operation of the Deactivation Furnace. Although mercury contamination was not associated with operation of the Deactivation Furnace, this SWMU will be designated the Deactivation Furnace Mercury Contamination. This is to differentiate it from a second Deactivation Furnace at CAMDS.

Tooele Army Depot has submitted to U.S. Environmental Protection Agency (EPA) Region VIII a Part A Notification and a Research Development and Demonstration (RD&D) Permit application for CAMDS pursuant to RCRA. CAMDS operates as a pilot plant to demonstrate baseline technology in the general areas of chemical munitions handling and disassembly, incineration of wastes resulting from chemical munitions handling and pollution abatement systems. In addition, a Part B permit was issued June 30, 1989 for the Chemical Stockpile Disposal System by the State of Utah Department of Health, Bureau of Solid and Hazardous Waste.

The 1984 RCRA amendments provided new authority to EPA to require comprehensive corrective actions on SWMUs and other areas of concern at interim status facilities and those applying for RCRA Part B permits. The intent of this authority is to address unregulated release of hazardous constituents to air, surface water, soil, groundwater, and the generation of subsurface gas. In order to accomplish this objective, a RCRA facility assessment is undertaken and consists of a preliminary review, visual site inspection and, if appropriate, site sampling and analytical characterization.

This report summarizes the results of a files search and review, visual site inspection of CAMDS and the Deactivation Furnace Mercury Contamination, and data evaluation. Primary sources of information utilized in this RFI Phase I summary include the facility's RD&D permit and Tooele Army Depot files, interviews with Tooele Army Depot personnel, walk-through inspections conducted with Tooele Army Depot Environmental Management personnel and the CAMDS assistant plant manager, and the Weston, 1989 Remedial Investigation draft report for S-TEAD.

Section 2.0 of this report describes the Tooele Army Depot's history, mission and ownership. Section 3.0 provides an overview of the environmental setting including: geology, hydrogeology, physiography, hydrology, water quality, and meteorology. Section 4.0 provides unit description and discussion of the nature and extent of contamination for the SWMUs with known release. References used in this report are listed in Section 5.0 and Section 6.0 presents a number of photos taken at both units with known releases.

## 2.0 SITE BACKGROUND

The Tooele Army Depot (TEAD) is located in North Central Utah. The TEAD Complex consists of three physically separated areas: South Area, North Area, and Hill Air Force Base Rail Shops. The general location of TEAD Complex North and South Areas are shown on Figure 2-1. Hill Air Force Base is located approximately 45 miles northeast of the Tooele Army Depot near Ogden, Utah and is not shown on Figure 2-1. Figure 2-2 is an area map of S-TEAD (USATHAMA, 1988).

### 2.1 Installation History

TEAD was established in April 1942 by the Army Ordnance Department. S-TEAD, formerly named the Deseret Chemical Warfare Depot, was used as a storage depot for Chemical Corps toxics. The storage facility included 140 igloos, 2 magazines, 7 warehouses, 32 toxic sheds, and several transitory storage shelters. The storage depot activity was discontinued in 1962, at which time the installation became part of the Tooele Army Depot, and was designated as the South Area (USATHAMA, 1988). The Chemical Agent Munitions Disposal System (CAMDS) was designed and built in 1979 in the South Area. CAMDS designs and tests processes and equipment to demilitarize and detoxify chemical munitions (Tooele Army Depot, 1985b, USATHAMA, 1979).

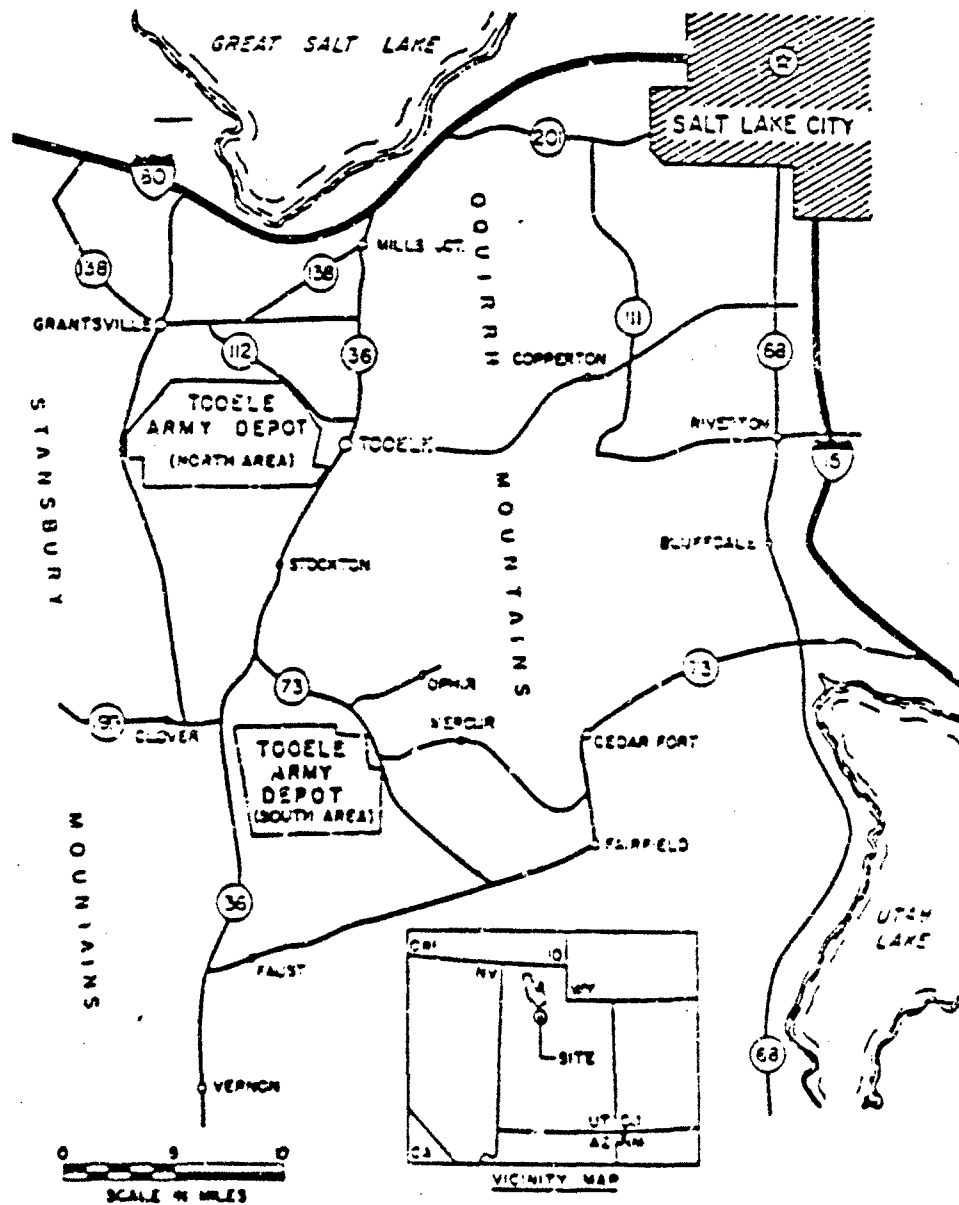
The current mission of TEAD is to:

- 1) provide for the receipt, storage, issue, maintenance, and disposal of assigned commodities;
- 2) provide installation support to attached defense organizations; and
- 3) operate other facilities as may be assigned.

In support of TEAD mission S-TEAD in the storage and maintenance of chemical munitions, and demilitarization and surveillance of ammunition (USATHAMA, 1988).

### 2.2 Location

S-TEAD is located approximately 15 miles south of the North Area (the administrative headquarters of TEAD Complex). S-TEAD is situated in Rush Valley and is bounded on the west by the Stansbury Mountains, on the east by the Oquirrh Mountains, and on the north by South Mountain and the Stockton Bar. The Sheep Rock and West Tintic Mountains are to the south. S-TEAD comprises an area of approximately 19,364 acres. The area surrounding S-TEAD is a sparsely settled, rural area. Population density is approximately three persons per square mile in the Valley, with the entire population concentrated in a few communities. The closest town is Stockton located approximately 10 miles north of S-TEAD; in 1980, the population of Stockton was 522 (USATHAMA, 1988, Tooele Army Depot, 1985a).



**Donohue**

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OCTOBER, 1966

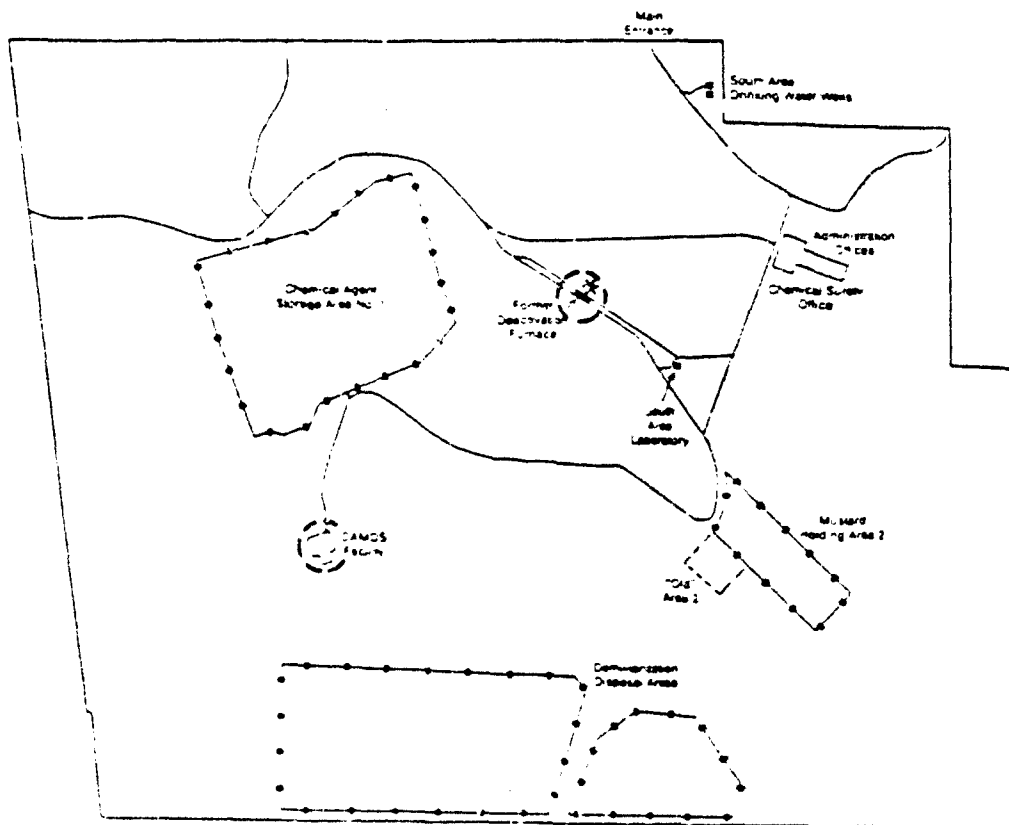
Engineers • Architects • Scientists

## GENERAL LOCATION MAP

**SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH**



**FIGURE 2-1**



### LEGEND

○ KNOWN RELEASE SITES,  
AREAL EXTENT NOT TO  
SCALE

\* DEACTIVATION FURNACE  
MERCURY CONTAMINATION

SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. 1, 1989

0 6,000 12,000  
SCALE: FEET

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17263

OCTOBER, 1989

### SITE LOCATION MAP

SOUTH TOOELE NCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH



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FIGURE 2-2

### 3.0 POTENTIAL MIGRATION PATHWAYS

Potential migration pathways for contaminants of concern at the S-TEAD facility (of which the CAMDS and Deactivation Furnace Mercury Contamination areas are a part) are influenced by the physical environment, such as meteorology, physiography, geology, soils, surface and groundwater hydrology. Important aspects of each are discussed below.

#### 3.1 Air (Meteorology)

Air is a potential pathway for windblown contaminants which occur as volatilized species, windblown particles or as contaminants adsorbed on suspended particulates. Local meteorologic and climatic conditions influence the extent to which air acts as a contaminant pathway.

S-TEAD has a semi-arid/cold desert climate characterized by hot, dry summers and cold winters. The average monthly temperature ranges from a high of 75°F in July to a low of 28°F in January (EA, 1986). Local winds are light (average annual velocity = 8.7 mph) and circulate through the valley due to uneven heating and cooling of land surfaces (EA, 1987). Prevailing winds are from the south towards the Great Salt Lake to the north during summer months, and from the north to the south during winter months (EA, 1987). Local diurnal variations in air circulation patterns occur due to differential heating and cooling of land surfaces in relation to lake surface temperatures (RI, 1989).

Annual precipitation is 10-12 inches per year with about 6 inches occurring as winter snowfall. Humidity is low to moderate and averages 44% (USATHAMA, 1979). Summer thunderstorms occur sporadically, however flash floods are a potential due to an annual average precipitation of 40 inches in the mountains surrounding Rush Valley (Montgomery, 1987).

#### 3.2 Physiography

Rush Valley is a part of the Basin and Range physiographic province. This province is characterized by a series of elongated North-South trending mountain ranges separated by intervening lows or valleys. The mountains are bounded by alluvial fans, sloping toward the axis of Rush Valley. S-TEAD, in the north-central portion of Rush Valley, slopes gently from the northeast to southwest (Figure 3-1) and is positioned on fans originating at the lower slopes of the Oquirrh Mountains.

#### 3.3 Geology and Soils

Both regional and site geology influence structure and development of site soils. Soil properties influence contaminant movement and constitute a contaminant pathway.

The regional geology of Rush Valley is characterized by major faulting which has produced a zone of trenches, elongated plateaus and ranges (RI, 1989). Extensive alluvial and lacustrine deposits were laid down as sediment slopes from mountain drainage courses and as lake bed deposits in the ancient Lake

Bonneville during the last tertiary period (EA, 1987). These deposits are of two ages: an older sequence of Tertiary age and a younger sequences of Quaternary age. The older sequence consists of moderately consolidated sands, gravels, silts and clays with an abundance of volcanic ash (Ever H & Kallser 198). The top of this sequence is at a depth of 800-900 feet. Relatively unconsolidated deposits of of sands, gravels, silts and clays of the Quaternary age comprise the surficial geology in the region of S-TEAD and exist to a depth of approximately 500 feet (EA, 1987) (Figure 35). Underlying the unconsolidated deposits are limestone and sandstone of Mississippian age.

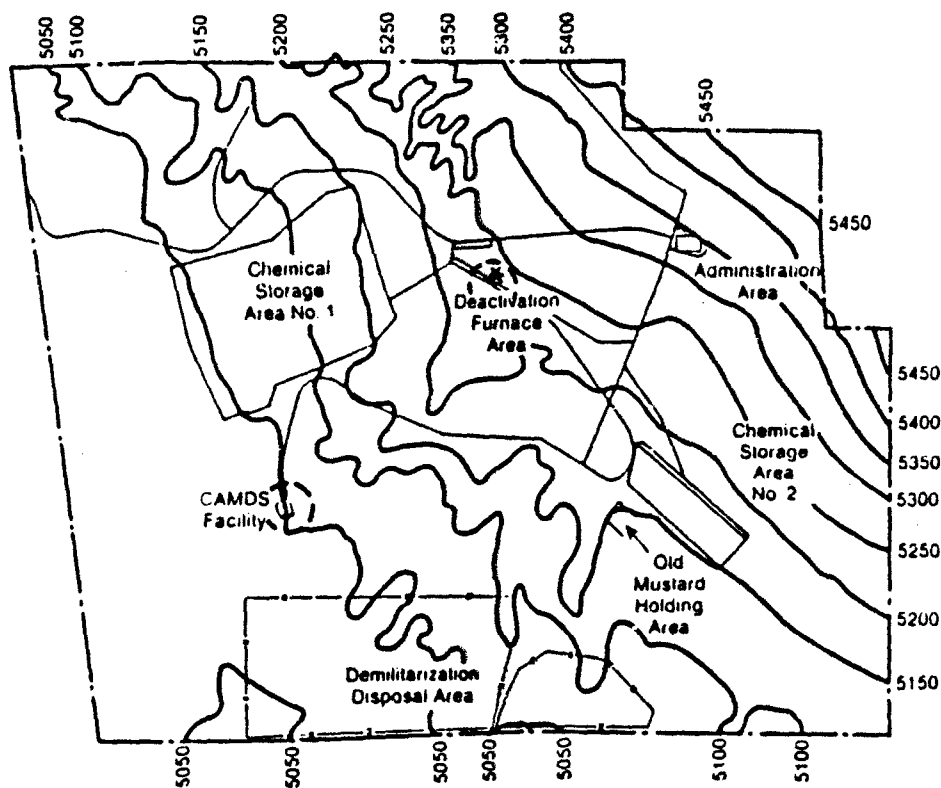
The soils in S-TEAD which are derived from the surficial alluvial and lacustrine deposits consist of two surficial types: 1) colluvium and alluvium deposits with a moderate to high permeability; and 2) lake bed sediments with a low to moderate permeability.

The soil classification for the colluvium and alluvium deposits is Neola gravelly loam (USATHAMA, 1979). This material is moderately saline and alkaline, and consists of shallow silts with occasional lime-cemented gravelly hardpan within 20 inches of the surface and a gravelly loam underneath. With a deficiency of water, dry soils do not develop strong diagnostic horizons except for salt crusts or a concretionary layer. During dry periods, water can be drawn upward through the soil by capillarity and evaporate either in the soil profile or at the ground surface. Calcium carbonate (caliche), or in this case a lime-cemented hardpan, may accumulate in desert soils in this manner and form layers in the soil.

The alluvium forms a broad, gently inclined detrital surface called a bajada, created by coalescing alluvial fans extending from the base of the Oquirrh Mountains toward the center of Rush Valley. Deposition of material eroded from the Oquirrh Mountains ranges from coarse gravel near the mountains to sand and silt toward the basin center. The lake bed sediments, which are somewhat saline and alkaline, consist of a deep, silty clay loam with occasional high concentrations of soluble minerals and thin sheets of sand (RI, 1989). Depositional characteristics are shown for the subsoils under the CAMDS facility area in Figure 3-6.

### 3.4 Hydrology

Rush Valley is part of a large interior drainage basin, the Great Salt Lake Basin. Drainage into the Valley is through streams which flow intermittently during snowmelt or summer rainfall. Two prominent intermittent streams, Ophir Creek and Mercur Creek (and other unnamed tributaries) flow from the Oquirrh Mountains on the east through S-TEAD. The drainage pattern is from northeast to southwest. Drainage from Rush Valley flows northwest across the southwestern portion of S-TEAD (Figure 3-2). These streams constitute a potential pathway for contaminants through surface flow, and potential groundwater pathway through ponding and subsurface infiltration. A perimeter drainage ditch recently constructed on the southeast section of the facility diverts flow from Mercur Creek around the facility, and the railroad spur embankment directs water from the north of S-TEAD to the west through a culvert at the property boundary.



Source EA 1988 (U.S. Army 1982)

### LEGEND

— 5450 — ELEVATION CONTOUR MSL

( ) KNOWN RELEASE SITES,  
AREAL EXTENT NOT TO  
SCALE

\* DEACTIVATION FURNACE  
MERCURY CONTAMINATION

SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. 1, 1989

0 5,000 10,000



SCALE: FEET

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OCTOBER, 1989

### TOPOGRAPHIC RELIEF OF S-TEAD

SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH



FIGURE 3-1

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Surface water originating as runoff on S-TEAD from precipitation events or from some of the intermittent streams that flow onto S-TEAD, is controlled by natural and manmade surface drainage channels (Figure 3-2). These channels direct surface water flow into low areas, or playas, that flood during periods of heavy precipitation or snowmelt. A shallow, flat-bottomed intermittent stream, Faust Creek, enters the southwestern corner of S-TEAD and flows in a northerly direction. During heavy rainfall or snowmelt, Faust Creek develops a relatively high stream flow that overtops the stream banks and floods the surrounding area (due to the damming effect of the local railroad embankment). A large shallow lake forms over several hundred acres in a low area along the west-central portion of S-TEAD as a response to the heavy flows of Faust Creek (R1, 1989).

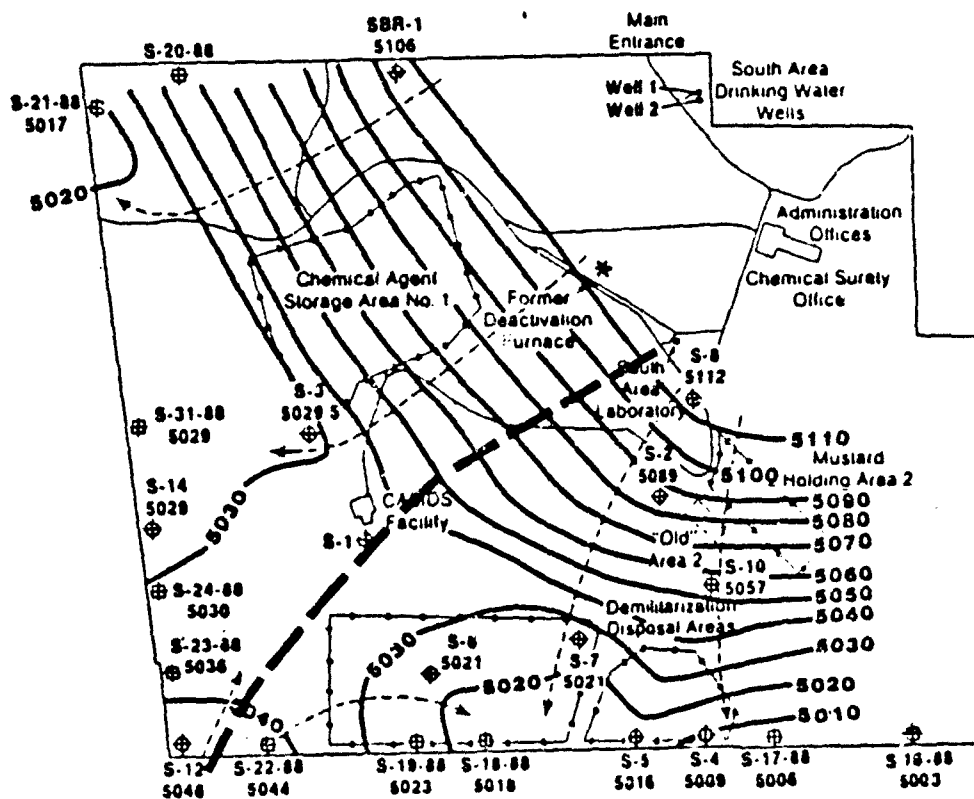
Surface water that collects north of the Clover Siding railroad spur flows into a natural drainage system that has an outlet from S-TEAD, through a break in the railroad embankment, and into Rush Valley west of S-TEAD.

Along the perimeter in the south-central portion of S-TEAD, a playa exists that controls flow onto S-TEAD from the southerly adjacent off-site area. This playa is normally dry. However, shallow, low-land flooding can occur during heavy precipitation events. This playa is interconnected with a larger broad, flat area, or "depression". This "depression" is a surface feature that trends northwest from approximately 2 miles south of the southeast corner of S-TEAD through the southwestern portion of S-TEAD and into the axis of Rush Valley.

### 3.5 Hydrogeology

The groundwater flow system constitutes a potential major migration pathway for contaminant transport. The groundwater flow system in S-TEAD occurs generally under unconfined conditions with local areas of semiconfined conditions. The depth to water ranges from less than 10 feet in the southwest corner to 300 feet in the northeast corner. Groundwater within the regional flow system moves from areas of recharge to areas of discharge. Recharge principally occurs from the loss of water from streams that originate in the mountain ranges that surround Rush Valley. These streams typically disappear as they travel across the coalesced colluvial fans that slope from the mountain front towards the center of the valley. Recharge is through gravel benches and alluvial fans surrounding the valley. Ophir Creek is a perennial stream originating in the Oquirrh Mountains to the east and enters S-TEAD as an intermittent stream in the northeast corner. Water derived from seasonal precipitation in the Oquirrh Mountains is the principal source of recharge to the alluvial fans bounding the eastern edge of S-TEAD. Recharge to S-TEAD groundwater system also occurs from Faust Creek, an intermittent stream originating in the Onaqui Mountains which enters the southwest portion of the site.

Groundwater flow for S-TEAD is shown in Figures 3-3 and 3-4. Groundwater flows primarily from the northeast, fanning out across the site and moving to the west, southwest, and south. Groundwater in the southwest corner of the site flows from the southwest, parallel to the axis of the drainage of Faust Creek, fanning out across the extreme southwest corner of S-TEAD. Groundwater flow directions become complex in the topographic basin, which comprises the southwest quadrant of S-TEAD.



#### Legend

- ◆ Approximate Location of ERTEC Wells
- ◆ Approximate Location of EA Wells
- Approximate Locations of Weston Wells
- Groundwater Level Contour
- - - Groundwater Flow Direction
- 5034 Groundwater Elevation May 1988 (Elevation  $\pm$  1 Ft)
- Groundwater Divide
- \* DEACTIVATION FURNACE MERCURY CONTAMINATION

SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. I, 1989

0 6,000 12,000

SCALE: FEET

## Donohue S-TEAD GROUNDWATER MONITOR WELL LOCATIONS AND POTENTIOMETRIC SURFACE MAP, MAY 1988

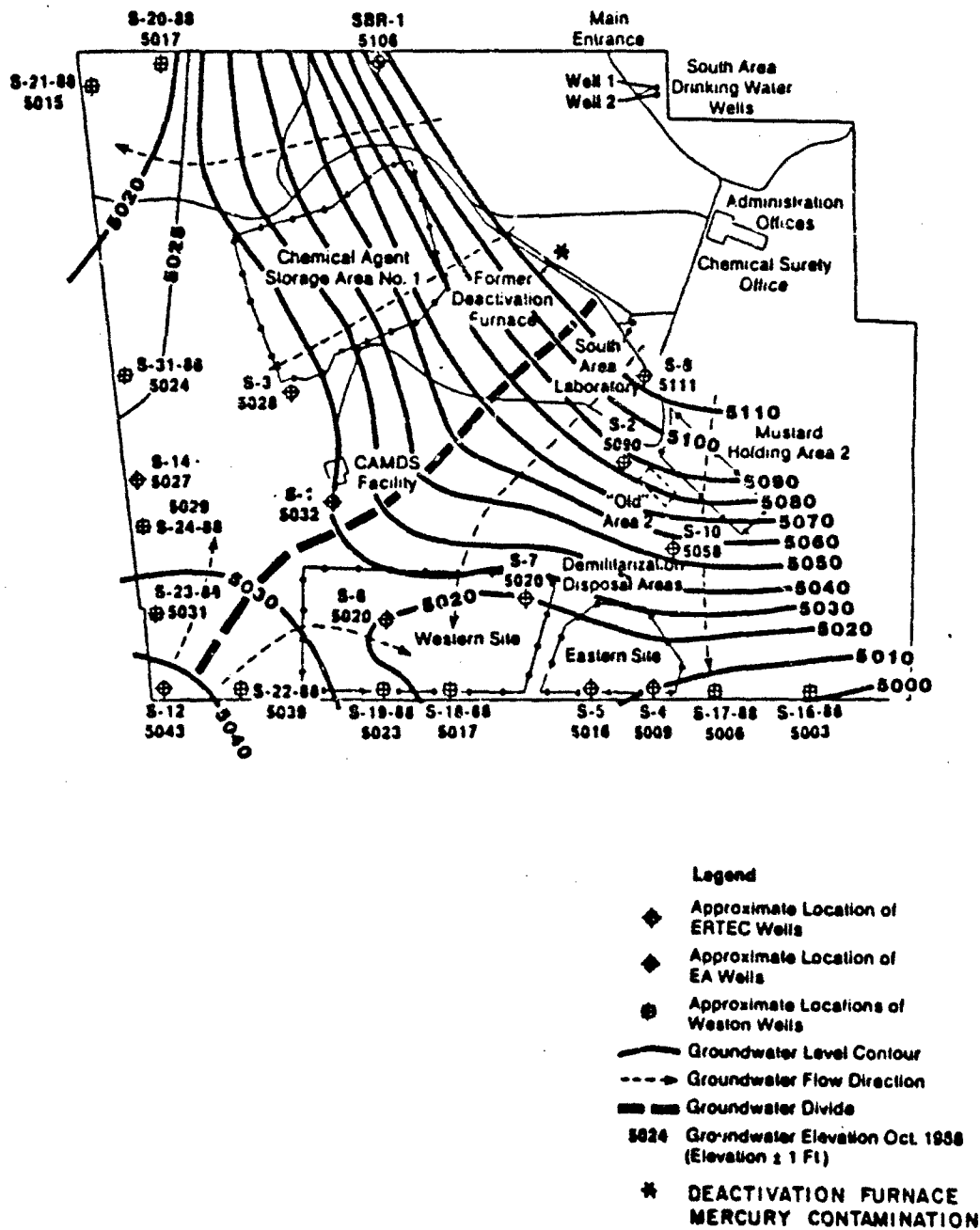
17263

OCTOBER, 1988

SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH

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FIGURE 3-3



SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. I, 1989

0 6,000 12,000  
SCALE: FEET

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**S-STEAD GROUNDWATER MONITOR WELL  
LOCATIONS AND POTENTIOMETRIC SURFACE,  
OCTOBER, 1988**

SOUTH TOOELE RCHA SUMMARY REPORT  
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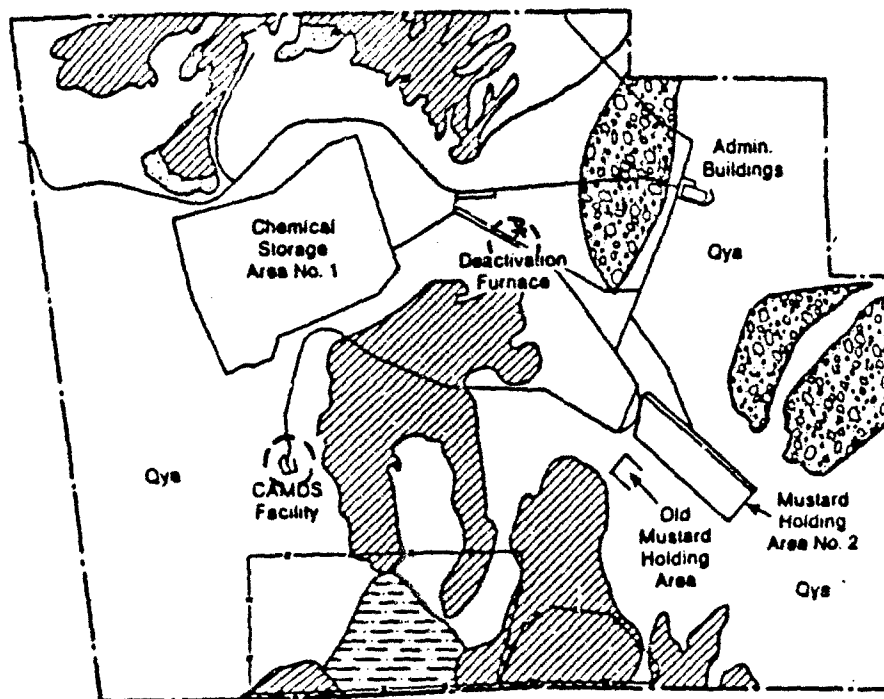
FIGURE 3-4

A groundwater divide is present across the site (Figure 3-3 and 3-4). The groundwater divide runs to the northeast, extending from the southwest corner of S-TEAD to the South Area laboratory. Along this groundwater divide, there are two directions of flow. The major component of groundwater flow comes from the northeast and is representative of recharge from the Oquirrh Mountains. Northwest of the divide, groundwater flows to the south. The secondary component of groundwater flow is from the southwest and is representative of recharge from the Onaqui Mountains and seasonal flows in Faust Creek. In this region, northwest of the divide, groundwater flows to the north. Southeast of the divide, groundwater flows to the south (RI, 1989).

The velocity of groundwater flow was estimated by defining representative flow paths and then applying Darcy's Law using the hydraulic conductivity, potentiometric head gradient, and porosity values appropriate to the site (Freeze and Cherry, 1979).

The general groundwater flow velocity across S-TEAD is estimated to be 4 to 24 ft/yr and in a westerly-southwesterly direction. In the southwestern tip of S-TEAD groundwater flow is in a northerly-northeasterly direction (Figures 3-3, 3-4). Groundwater flow velocities along the western and southern portions of S-TEAD are low because the gradient of the potentiometric surface is very small. The potentiometric surface is steeper over the remainder of S-TEAD and provides for higher groundwater flow velocities. Even the higher flow velocities are not that high, primarily due to the fine-grained nature of the aquifer materials present at S-TEAD.

The estimated groundwater flow velocities and travel times can be considered only general estimates of possible contaminant movement over the site. These estimates do not reflect the possible effects of retardation and dispersion of contaminants in groundwater. The retardation and dispersion process can modify the movement of contaminants with respect to average groundwater flow rates. The overall effect of dispersion is the dilution of contaminant concentrations. Retardation, which results from the adsorption of contaminants to soil particles, increases transport times.



Source: EA 1988, Compiled From Utah Geological and Mineral Survey, 1980

### LEGEND

- |   |  |      |   |
|---|--|------|---|
| ○ | KNOWN RELEASE SITES, AREAL EXTENT NOT TO SCALE | Ob   | Shore Deposits A Thin Veneer of Gravel, Sand, and Silt                                  |
| * | DEACTIVATION FURNACE MERCURY CONTAMINATION     | QToa | Alluvium Ranging From Coarse Gravel Near Mountains to Sand and Silt Toward Basin Center |
|   |  | QTP  | Pediment Cut on Salt Lake Group Capped With Alluvium (QToa)                             |
|   |  | Qys  | Alluvium Mostly Very Thin Sheets of Sand or Silt  |
|   |  | P    | Plays Flat Plain of Silt or Clay  |

SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. I., 1989



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OCTOBER, 1989

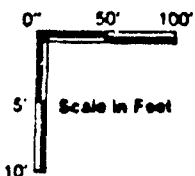
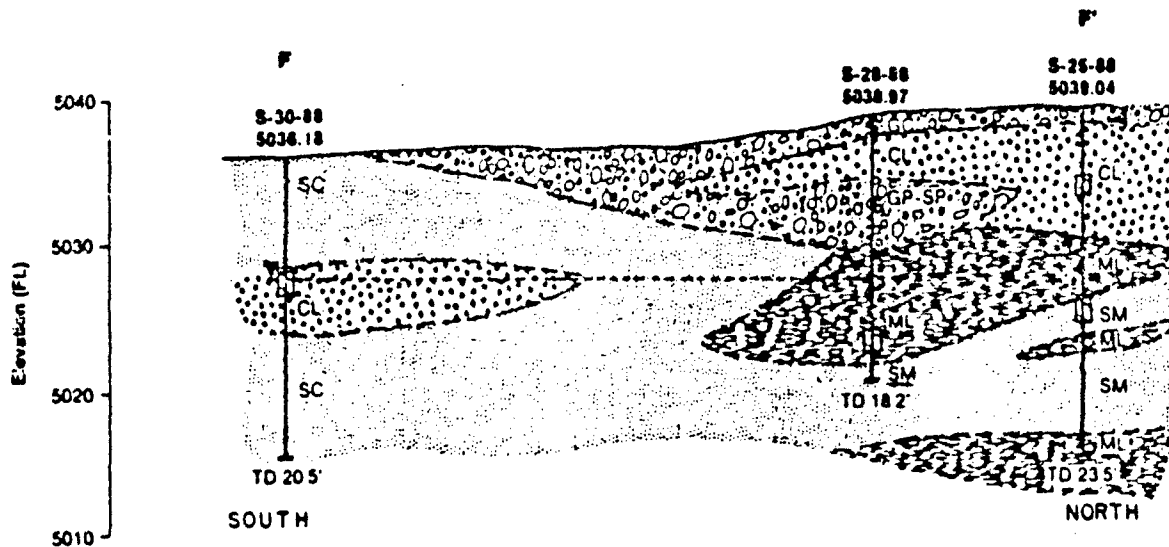
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### S-TEAD SURFICIAL GEOLOGY

SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH



FIGURE 3-5



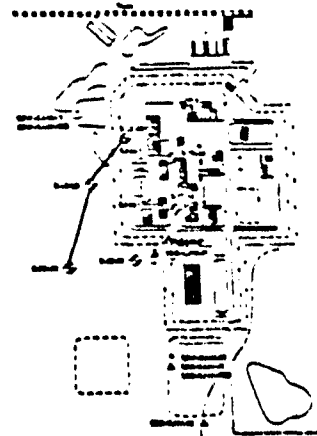
\*NOTE Subsoil Classification Based on Field Geologist Interpretation Using the Unified Soil Classification System or, Where Indicated, Based on Geotechnical Laboratory Testing of a Soil Sample

#### Legend

- Estimated/Interpreted Soil Boundaries
- Gravelly Soils (G.C., GP)
- Sandy Soils (SM, SP, SC)
- Silty Soils (ML)
- Clayey Soils (CL)

#### Unified Soil Classification\*

- ML Silt, Clayey and/or Silty
- CL Clay, Low Plasticity
- SM Silty Sand
- SC Clayey Sand
- GP Gravel
- GC Clayey Gravel
- TD Indicates Groundwater Level Measured October 1988
- TD Total Depth Drilled
- Location of Geotechnically-Tested Sample



0 100 200  
SCALE FEET

SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. 1, 1989

SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. 1, 1989

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OCTOBER, 1989

## GEOLOGICAL CROSS-SECTION F-F' CAMDS FACILITY AREA

SOUTH TOOELE NCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH

FIGURE 3-6

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#### 4.0 SOLID WASTE MANAGEMENT UNITS WITH KNOWN RELEASES

A RCRA Facility Assessment (RFA) was conducted in 1987 at Tooele Army Depot -- South Area which identified two solid waste management units (SWMUs) with known releases. These SWMUs are the Chemical Agent Munitions Disposal System (CAMDS) and the Deactivation Furnace Mercury Contamination. This section provides a physical description and a discussion of what is known of the nature and extent of contamination at these units.

##### 4.1 Chemical Agent Munitions Disposal System

CAMDS has been in operation since 1979 conducting research into and development of various methods of demilitarizing lethal chemical munitions and treating the wastes resulting from demilitarization processes. CAMDS operates as a pilot plant to demonstrate baseline technology in the general areas of chemical munitions handling and disassembly, incineration of wastes resulting from chemical munitions handling, pollution abatement systems associated with incineration and chemical munitions handling, and treatment of wastes such as scrap metal, brines, and ash to minimize the amount of waste requiring disposal (RD&D, 1989).

CAMDS is located in the southwest quadrant of Tooele Army Depot - South Area, south of the Chemical Agent Storage Area (Figure 2-2). The entire CAMDS area covers an area of 700 acres. The demilitarization activity is conducted in a complex of structures enclosed within a 10-acre fenced site. With the exception of a newly constructed structure outside of the facility to the south and the facility itself, the CAMDS use area is undeveloped. The facility is served by rail and street access. A helipad is located adjacent to the east of the perimeter fence (USATHAMA, 1988, RCRA RD&D Permit, 1989).

##### 4.1.1 Chemicals Used and Wastes Generated

CAMDS demilitarizes various types of lethal chemical agent munitions, as well as bulk items of agent. The munitions include cartridges, projectiles, rockets, and mines containing the agents GB, VX, and mustard. The bulk items include bombs, spray tanks, and ton containers containing GB, VX, GA, mustard, and L. Table 4-1 presents the composition of specific munitions and bulk items. Agents GA, GB and VX, and the blister agents (H, HD, HT, and L) are classified as acutely hazardous by the State of Utah. The EPA has not listed the lethal chemical agents as hazardous wastes in the RCRA regulations, but contends that these chemicals meet the hazardous waste characteristic of reactivity since they could generate toxic gases, etc., when mixed with water. All residues generated by the demilitarization of GB, VX, and mustard are classified by the State of Utah as hazardous (F999) because of their toxicity (RD&D, 1989). As of July 10, 1987, the following munitions and agents have been destroyed:

TABLE 4-1  
COMPOSITION OF MUNITIONS AND BULK ITEMS

<u>Munition</u>	<u>Agent<sup>c</sup></u>	<u>Fuze</u>	<u>Burster</u>	<u>Propellant</u>	<u>Dunnage</u>
M55 115-mm rockets <sup>a</sup>	GB, VX	Yes	Yes	Yes	Yes
M23 land mines	VX	Yes	Yes	No	Yes
4.2-in. mortars	HD, HT	Yes	Yes	Yes	Yes
105-mm cartridges	GB	Yes	Yes	Yes	Yes
105-mm projectiles	GB	No	No	No	Yes
155-mm projectiles	GB, VX, H	No	Yes <sup>b</sup>	No	Yes
8-in. projectiles	GB, VX	No	Yes <sup>b</sup>	No	Yes
Bombs (525 & 750 lb)	GB	No	No	No	Yes
Spray tanks	VX	No	No	No	No
Ton containers	GB, VX, CA, HD, L	No	No	No	No

<sup>a</sup>M55 rockets are processed in individual fiberglass shipping containers.

<sup>b</sup>A minority of projectiles are stored without bursters.

<sup>c</sup>Chemical nomenclature of agents:

GB - Sarin or isopropylmethylphosphonofluoridate  
VX - o-ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate  
HD - Distilled mustard or bis(2-chloroethyl) sulfide  
HT - Mixture of bis-(2-chloroethyl sulfide) and  
bis[2(2-chloroethylthio)ethyl]ether  
H - Levinstein mustard or bis-(2-chloroethyl) sulfide  
GA - Tabun or ethyl N,N-dimethyl phosphoramidate-cyanidate  
L - Lewisite or dichloro-2-chloro vinyl arsine

Source: RD&D, 1989

R/USATHAMA/AA3

<u>Item</u>	<u>Quantity</u>
<u>Munitions</u>	
M55 GB Rockets	17,978 each
105 MM Projectiles	7,771 each
155 MM Projectiles	11,860 each
<u>Agents</u>	
Agent GB (Neutralization)	181,945 lb.
Agent GB (Incineration)	75,532 lb.
Agent VX (Incineration)	7,866 lb.

(USATHAMA, 1988)

Table 4-2 identifies each of the known hazardous wastes generated and/or managed by the facility, along with their respective hazardous waste designation and code, the regulatory citation for the relevant definition or criterion for designating the waste as hazardous and the specific data or rationale relating the waste to that criteria.

In addition to the substances listed in Table 4-2, some M55 rockets are encased in fiberglass shipping and firing tubes that contain polychlorinated biphenyl compounds (PCBs) in the fiberglass binder. Approximately one-fourth of the M55 rocket inventory contains approximately 12.5 grams, or 2,000 ppm, of PCB in the shipping and firing tubes. The remaining three-fourths of the M55 rocket inventory contain PCBs at less than 50 ppm. PCBs present in concentrations greater than 50 ppm are subject to the Toxic Substances Control Act. According to the RD&D RCRA permit, this issue is being addressed separately with the USEPA's Office of Toxic Substances (RD&D, 1989). Although the RD&D permit indicates that these shipping and firing tubes are treated only in the Deactivation Furnace System, the CAMDS plant manager has indicated that no PCB-containing materials will be burned at the facility until the issue has been addressed with the EPA.

Because CAMDS is designed to test new equipment and new methods for demilitarizing many different types of chemical munitions, the plant was designed to be flexible enough to use different flow schemes and equipment. The methods of destroying the various munitions include incineration of agents, incineration of residual agent contamination on metal parts and inert munition components, and incineration of explosive components. Only one type of agent is processed at any one time. To provide the flexibility required to develop each process, CAMDS provides subsystems that can be used in whole or in part for each munition process. These subsystems include:

- Munitions Holding Area
- Unpack Area(s)
- Blast containment operating areas  
(Explosive Containment Cubicle Nos. 1 and 2)
- Munition Disassembly/Agent Drain Equipment  
(rocket, mine, projectile, mortar and bulk containers)

TABLE 4.2  
RCRA HAZARDOUS WASTE DESIGNATION AND RATIONALE

Waste Material	RCRA Hazardous Waste		RCRA Hazardous Waste		Basis for Designation
	Designation Code	Definition	Regulatory Citation	Definition	
<b>Agents</b>					
CB	Reactive (D003)		40 CFR 261.23(a)(4)		The EPA has declared the lethal chemical agents (B, VX, and mustard) to be hazardous on the basis of the characteristic of reactivity (D003) because they generate toxic gases, etc., when mixed with water; CB, VX, mustard, GA, and L are also classified as acutely hazardous by the State of Utah.
	Acutely Hazardous (P999)		40 CFR 261.23(a)(4)		
VX	Reactive (D003)		40 CFR 261.23(a)(4)		
	Acutely Hazardous (P999)		40 CFR 261.23(a)(4)		
Mustard	Reactive (D003)		40 CFR 261.23(a)(4)		
	Acutely Hazardous (P999)		40 CFR 261.23(a)(4)		
GA	Reactive (D003)		40 CFR 261.23(a)(4)		
	Acutely Hazardous (P999)		40 CFR 261.23(a)(4)		
L	Reactive (D003)		40 CFR 261.23(a)(4)		
	Acutely Hazardous (P999)		40 CFR 261.23(a)(4)		
<b>Explosives</b>					
Tetryl	Reactive (D003)		40 CFR 261.23(a)(8)		Contains Class A explosives, tetryl, and TNT as per 49 CFR 173.53.
Tetryl	Reactive (D003)		40 CFR 261.23(a)(8)		Is a Class A explosive, as per 49 CFR 173.53.
Comp. B	Reactive (D003)		40 CFR 261.23(a)(8)		Contains Class A explosives, RDX and TNT, as per 49 CFR 173.53.
<b>Propellants</b>					
M6	Reactive (D003)		40 CFR 261.23(a)(8)		Class B explosive as per 49 CFR 173.53
M28	Reactive (D003)		40 CFR 261.23(a)(8)		Class B explosive as per 49 CFR 173.53
M67	Reactive (D003)		40 CFR 261.23(a)(8)		Class B explosive as per 49 CFR 173.53
<b>Explos</b>					
M8	Reactive (D003)		40 CFR 261.23(a)(6)		Capable of explosive reaction is subjected to strong initiating source or heated under confinement.
M51A5	Reactive (D003)		40 CFR 261.23(a)(6)		Capable of explosive reaction if subjected to strong initiating source or heated under confinement.
M617	Reactive (D003)		40 CFR 261.23(a)(6)		Capable of explosive reaction if subjected to strong initiating source or heated under confinement.
M508	Reactive (D003)		40 CFR 261.23(a)(6)		Capable of explosive reaction if subjected to strong initiating source or heated under confinement.
M603	Reactive (D003)		40 CFR 261.23(a)(6)		Capable of explosive reaction if subjected to strong initiating source or heated under confinement.

TABLE 4-2  
(continued)

Waste Material	RCRA Hazardous Waste Designation Code	RCRA Hazardous Waste Definition Regulatory Citation	Basis for Designation
<u>Miscellaneous Munitions</u>			
M63 (Detonator)	EP Toxic (Ba)(D005) EP Toxic (Pb)(D008) Reactive (D003)	40 CFR 261.24(b) 40 CFR 261.24(b) 40 CFR 261.23(a)(6)	Contains EP Toxic metals, lead and barium, and contains a Class A explosive, RDX, as per 49 CFR 173.53
M2 (Squib)	EP Toxic (Pb)(D008) Reactive (D003)	40 CFR 261.24(b) 40 CFR 261.23(a)(6)	Contains an EP Toxic metal, lead, and contains a Class A explosive, nitrocellulose, as per 49 CFR 173.53
M62 (Igniter)	Reactive (D003)	40 CFR 261.23(a)(6)	Contains a Class A explosive, nitrocellulose, as per 49 CFR 173.53
M38 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 40 CFR 173.53
M48 (Initiator)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M34 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M36 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M5 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M6 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M14 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M37 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M40 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M40A (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M71 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
M83 (Burstor)	Reactive (D003)	40 CFR 261.23(a)(8)	Class A explosive as per 49 CFR 173.53
<u>Spent Decontamination Solution</u>			
GB (NaOH)	Toxic (F999)	UHWPR 2.1.8	Spent decontamination solutions for GB, VX, and mustard are listed hazardous wastes by the State of Utah as residues from the demilitarization of H, HD, HT, GB, and VX.
VX/Mustard/(NaOH)	Toxic (F999)	UHWPR 2.1.8	

TABLE 4.2  
(continued)

Waste Material	RCRA Hazardous Waste Designation Code	RCRA Hazardous Waste Definition Regulatory Citation	Basils for Designation
<u>GA (NaOCl)</u>	Toxic (F999)	UHWPR 2.1.8	Because of the large volume of decontamination solution used to neutralize agent and because of 10X dilution with water after decontamination, resulting spent decontamination solution is neither reactive (from agent) nor corrosive (from decontamination). Spent decontamination solution for L would be expected to contain arsenic.
L (NaOCl)	EP/Toxic (D004) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	
<u>Scrubber Brine</u>			
CB Brine	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The brine has been observed to contain EP Toxic metals above defined levels. The brine is a listed hazardous waste in the State of Utah.
VX Brine	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The brine has been observed to contain EP Toxic metals above defined levels. The brine is a listed hazardous waste in the State of Utah.
Mustard Brine	EP Toxic Metals (D004 to D011) TOXIC (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The brine may contain EP Toxic metals above defined levels. The brine is a listed hazardous waste in the State of Utah.
CA Brine	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The brine may contain EP Toxic metals above defined levels.
L Brine	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The brine may contain EP Toxic metals above defined levels.
<u>Drzer Salts</u>			
CB PAS Salt	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The salts may contain EP Toxic metals above defined levels. The mustard salt may contain sulfides, CB, VX, and mustard RAS salts are listed hazardous wastes in the State of Utah.
VX PAS Salt	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	
Mustard PAS Salt	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	
GA PAS Salt	Reactive (D003) EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.23(a)(5) 40 CFR 261.24(a) UHWPR 2.1.8	

TABLE 4-2  
(continued)

Waste Material	RCRA Hazardous Waste Designation Code	Basis for Designation	
		RCRA Hazardous Waste Definition Regulatory Citation	
L PAS Salt	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	
Residue			
TDI PAS (Baghouse)	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The residue may contain EP Toxic metals. CB, VX, and mustard demilitarization residue are listed hazardous wastes in the State of Utah.
DFS Cyclone	EP Toxic Metals (D004 to D011) Agent Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	The residue may contain EP Toxic metals. CB, VX, and mustard demilitarization residue are listed hazardous wastes in the State of Utah.
Scrap Metal			
NPF	Not a RCRA Hazardous Waste	N/A	
DFS	Not a RCRA Hazardous Waste	N/A	
TDI	Not a RCRA Hazardous Waste	N/A	
Ash			
TDI Ash	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	These materials will be decontaminated to the XXXXX level by incinerating the scrap at 1,000° for 15 minutes. Scrap metal is exempt from regulation pursuant to 40 CFR 261.6(a)(3)(iv).
DFS Ash	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	Ash may contain EP Toxic metals. CB, VX, and mustard demilitarization residue are listed hazardous wastes in the State of Utah.
NPF Ash	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	Ash may contain EP Toxic metals. CB, VX, and mustard demilitarization residue are listed hazardous wastes in the State of Utah.
Other Miscellaneous Wastes			
HEPA Filters, Prefilters, Charcoal Filters	Reactive (D003) Toxic (F999)	40 CFR 261.23(a)(4) UHWPR 2.1.8	These filters are contaminated with agent. CB, VX, and mustard demilitarization residue are listed hazardous wastes in the State of Utah.
LIC salt slurry	EP Toxic Metals (D004 to D011) Toxic (F999)	40 CFR 261.24(a) UHWPR 2.1.8	Slurry may contain EP Toxic metals. CB, VX, and mustard demilitarization residue are listed hazardous wastes in the State of Utah.

TABLE 4.2  
(continued)

Waste Material	RCRA Hazardous Waste Designation Code	RCRA Hazardous Waste Definition Regulatory Citation	Basis for Designation
Laboratory Wastes	Toxic (F999)	UHWHR 2.1.8	Liquid laboratory wastes may contain CB, VX, or mustard agent, which are listed hazardous wastes in the State of Utah. Agent-contaminated solid wastes will also be managed as hazardous wastes.
Bulk Charcoal	Reactive (D003)	40 CFR 261.23(a)(4)	
	Toxic (F999)	UHWHR 2.1.8	
Beton #20 (hydraulic fluids)	Toxic (F999)	UHWHR 2.1.8	Bulk charcoal from the filter systems is expected to contain agents. Charcoal from filters used in managing CB, VX, and mustard agents is listed as a hazardous waste in Utah.
Fyrquac 220 (hydraulic fluids)	Toxic (F999)	UHWHR 2.1.8	
Surrogate Chemical Agents	Ignitable (D001) Toxic (U211) Toxic (U226)	40 CFR 261.21(c)(1) 40 CFR 261.23(f) 40 CFR 261.33(f)	Waste hydraulic fluids and residuals from treatment of munitions containing chemical agents.
Waste Fuel Oils	Ignitable (D001)	40 CFR 261.21(a)(1)	Surrogate chemical agents contain carbon tetrachloride and 1,1,1-trichloroethene and the mixture is reported to have a flash point of 136°F.
Waste Lubricants (30 weight motor oil)	Toxic (F999)	UHWHR 2.1.8	Waste fuel oils are reported to have a flash point of 125°F.
Cum Solvent/Hydraulic Fluids	Toxic (F999)	UHWHR 2.1.8	Waste lubricants are residuals from treatment of munitions containing chemical agents.

Notes:

DFS = Deactivation Furnace Mercury Contamination System  
DUM = Dummage Incinerator  
PAS = Pollution Abatement System  
HEPA = High-Efficiency Particulate Air  
MPF = Metal Parts Furnace  
LIC = Liquid Incinerator

Source: RDI/D, 1989, Table C.1.4

R/USATHAMA/AA4

- Incinerators (Deactivation Furnace System, Metal Parts Furnace, Toxic Dunnage Incinerator, and Liquid Incinerator)
- Pollution Abatement Systems (wet and dry)
- Ventilation System Filters
- Brine Drying Equipment
- Toxic Containment Buildings
- Residual Storage Area
- Personnel Support Facilities
- Chemical Laboratories (S3AF, S539, and S541 labs)
- Air Monitoring Network

Although the systems required for different munitions change, the basic process flow is as follows: munitions are delivered to the Munitions Holding Area from their storage site. The munitions are inspected for leaks in the holding area and subsequently manually unpacked in the Unpack Area. The munitions are then placed on a conveyor that introduces the munitions into the Explosive Containment Cubicle, are drained of agent and segmented to ensure controlled burning of all combustible components. The drained agent is collected in a holding tank which may be incinerated in the Liquid Incinerator, Deactivation Furnace System or returned to storage. Dunnage is disposed of by incineration in the Toxic Dunnage Incinerator. Explosive portions of the munitions and any residual agent are incinerated in the Deactivation Furnace System. The metal scrap is deposited in containers for disposal at an approved landfill, or recovered for sale as scrap metal. Spent decontamination solutions from the Explosive Containment Cubicle are collected in the Liquid Waste Collection and Storage System and are incinerated or dried in the Brine Drying Area. Incinerator effluents are treated in the Deactivation Furnace System or Metal Parts Furnace Pollution Abatement Systems. Scrubber liquors from the Pollution Abatement Systems are dried on drum dryers and the resulting salts are moved by contractor to an approved storage or disposal facility. Ash and residue generated from the demilitarization of agents GA, GB, VX, L and mustard are classified as hazardous (F999) by the State of Utah (RCRA RD&D Permit, 1989).

#### 4.1.2 Additional Waste Units and Areas of Concern at CAMDS

This is consistent with the data submitted and language of Permit UT 5210090002 from the State of Utah, Department of Health. The CAMDS facility is treated as one SWMU. The areas, structures or facilities associated with CAMDS are listed in Table 4-3; their locations are provided in Figures 4-1 through 4-3. The 39 waste tanks included as part of CAMDS also are listed in Table 4-4.

In addition, 12 areas of concern were identified. These are listed in Table 4-5 with locations provided in Figures 4-1 through 4-3.

TABLE 4-3  
AREAS, STRUCTURES AND FACILITIES  
ASSOCIATED WITH THE CAMDS  
SOLID WASTE MANAGEMENT UNIT

---

Incinerators

- Deactivation Furnace
- Metal Parts Furnace
- Toxic Dunnage Incinerator
- Liquid Incinerator

Below Grade and Underground Storage Tanks

(39) Tanks, 1A through 16C

\*\*See Table 4-4 for description and listing

Less than 90 day storage facilities

(2) satellite storage areas

Waste Lines

- Sewer Line
- Hot Waste Line
- Drainage Line

Pollution Abatement Systems

- Metal Parts Furnace Pollution Abatement System  
(Venturi scrubber, Cyclone separator and afterburner)
- Toxic Dunnage Incinerator Pollution Abatement System  
(scrubber with afterburner)

Boiler Blowdown Discharge Ditch and Ponding Area

Leachfields

- New Leachfield and Lagoon Systems
- Old Leachfield and Septic Tank
- Leachfield

"Old" Open Sewage Lagoon

---

Figure 4-1

Figure 4-3

TABLE 4.4  
BELOW GRADE AND UNDERGROUND WASTE TANKS

TANK NO. (1)	TANK LOCATION (1)	LIQUID CAPACITY GALLONS (2)	TANK SIZE INSIDE DIM. INCHES (3)	TYPICAL WASTES	DESTINATION OF WASTES	MATERIALS OF CONSTRUCTION (4)	DETECTION METHOD FOR LEAK INTO SECONDARY CONTAINMENT (5)
		TANK AT FULL				INSIDE WETTED	OUTSIDE
<b>A25</b>							
1A	(NOT USED) IN PIT FLOOR	300	48 DIA x 49	WASTE LIQUIDS	TANK 1C	CONC/PT	NONE
1C	ON PIT FLOOR	2,400	46 DIA x 96 H	WASTE LIQUIDS	THF STORAGE TANKS	NOT KNOWN	NONE
<b>B2A</b>							
2A	(IN FLOOR TANKS) EAST SIDE	240	43 SQ x 39	SCRUBBER BRINE WASHDOWN	BDA STORAGE TANKS	STL/PT	ELECTRONIC
2B	MECHANICAL ROOM	69	24 DIA x 36	CONDENSATE (NONE H.W.)	TANK 2A	FRP/RES	NONE
2C	AT DRYERS	14	20 SQ x 11	SCRUBBER BRINE WASHDOWN	TANK 2A	STL/PT	ELECTRONIC
2D	AT EVAPORATOR	14	20 SQ x 11	SCRUBBER BRINE WASHDOWN	BDA TANK T-13-E	STL/PT	ELECTRONIC
<b>B1F</b>							
3A	TANK IN PIT FLOOR (NOT USED)	120(10)	24 SQ x 48	NONE			
3B	ON PIT FLOOR	275(6)	54 DIA x 60 H	AGENT SPILLS WASHDOWN SHOWER WATER SPENT DECONS	THF STORAGE TANKS	FRP/RES	ELECTRONIC
<b>C05</b>							
4A	IN FLOOR TANK	1,885	84 x 72 x 72	WATER DECONS (NON. H.W.)	THF STORAGE OR BDA STORAGE TANKS	CONC/PT	NONE

TABLE 4-4  
(continued)

TANK NO. (1)	TANK LOCATION (1)	LIQUID CAPACITY GALLONS (2)	TANK SIZE INSIDE DIM. INCHES (3)	TYPICAL WASTES	DESTINATION OF WASTES	MATERIALS OF CONSTRUCTION (4)	DETECTION METHOD FOR LEAK INTO SECONDARY CONTAINMENT (5)
		TANK FULL				INSIDE WETTED	OUTSIDE
<b>DES</b>							
5A	(1M FLOOR TANKS) AT WEST END OF RETENTION TANKS	296	370	36 SQ x 29	SCRUBBER BRINE	STL/PT	STL/PT
					BDA STORAGE TANKS		ELECTRONIC
5B	HEATED DISCHARGE CONVEYOR	137	165	43 SQ x 29	WASHDOWN (NOM. H.W.)	STL/PT	STL/PT
					THF STORAGE TANKS		ELECTRONIC
5D	NORTH SIDE OF RETENTION TANKS	60	-	24 DIA x 36	SINK, EYEWASH (NOM. H.W.)	FRP/REG	--
							NONE
<b>EC/SEC</b>							
6A	1M PIT FLOOR (NORTHEAST CORNER)	22	20	20 SQ x 17	AGENT SPILLS SPENT WASHDOWN DECONS	HALAR	STL/PT
							ELECTRONIC
6B	OM PIT FLOOR (NORTHWEST CORNER)	20(6)	220	50 x 42 x 36	THF STORAGE SPENT DECONS SHOWER WATER	--	VISUAL
					PE TANKS		
6D	1M SEG. FLOOR	34	67	32 SQ x 16	AGENT SPILLS WASHDOWN SPENT DECONS	HALAR	STL/PT
					THF STORAGE TANKS		ELECTRONIC
<b>ELF</b>							
7A	1M PIT FLOOR (NORTHEAST CORNER)	45(6)	245	43 x 56 x 16	AGENT SPILLS SPENT DECONS WASHDOWN	HALAR	FRP
					THF STORAGE TANKS		ELECTRONIC
<b>LIC</b>							
8A	1M FLOOR TANK (PRIMARY CHAMBER)	113(7)	137	31 SQ x 35	AGENT SPILLS SPENT DECONS WASHDOWN SHOWER WATER	HALAR	STL/PT
					THF STORAGE TANKS		ELECTRONIC
8B	TANK AT BOTTOM OF AFTERBURNER (SECONDARY CHAMBER)	20	NO ALARM	23 2/4" DIA x 10 3/4"	SPENT DECONS SALT SLURRY	HAST	--
					SALT REMOVAL SYSTEM TANK BD OR BDA		VISUAL (TANK ABOVE VAULT 1B)
8C	TANK IN VAULT (AGENT TANK ROOM)	175	220	50 x 42 x 36 D	AGENT SPILLS SPENT DECONS WASHDOWN	PE	PE
					THF STORAGE TANKS		ELECTRONIC

TABLE 4-4  
(continued)

TANK NO. (1)	TANK LOCATION (1)	LIQUID CAPACITY (2)		TANK SIZE INSIDE DIM. INCHES (3)	TYPICAL WASTES	DESTINATION OF WASTES	MATERIALS OF CONSTRUCTION (4)		DETECTION METHOD FOR LEAK INTO SECONDARY CONTAINMENT (5)
		TANK FULL	TANK AT HIGH ALARM				INSIDE WETTED	OUTSIDE	
PDF									
9A	1 <sup>ST</sup> FLOOR TANK (LOADING AREA)	29(10)	NO ALARM	24 SQ x 12	NON-HAZARDOUS WASTES	PORTABLE TANK	CONC/PT	--	NO SECONDARY CONTAINMENT
9B	1 <sup>ST</sup> FLOOR TRENCH (LOADING AREA)	32(10)	NO ALARM	397 x 12 x 8	NON-HAZARDOUS WASTES	TANK 9A	CONC/PT	--	NO SECONDARY CONTAINMENT
9C	1 <sup>ST</sup> FLOOR TANK (HYD. ROOM)	29(10)	NO ALARM	24 SQ x 12	NON-HAZARDOUS WASTES	PORTABLE TANK	CONC/PT	--	NO SECONDARY CONTAINMENT
9D	1 <sup>ST</sup> FLOOR TRENCH (HYD. ROOM)	25(10)	NO ALARM	88 x 6 x 11	NON-HAZARDOUS WASTES	TANK 9C	CONC/PT	--	NO SECONDARY CONTAINMENT
9E	1 <sup>ST</sup> FLOOR TANK (MCH ROOM)	128 (6)	328	27 1/2 x 46 x 61	AGENT SPILLS SPENT DECONS WASHDOWN SHOWER WATER	TMF STORAGE TANKS	HALAR	FRP	ELECTRONIC
9F	TANK IN VAULT (CHARGE CAR AREA)	48 (7)	57	36 x 20 x 20	AGENT SPILLS SPENT DECONS WASHDOWN SHOWER WATER	TANK 9E	PVDF	FRP	VISUAL
9G	TANK IN FLOOR - DRAIN	0.5 (10)	NO ALARM	8 DIA x 5	AGENT SPILLS SPENT DECONS WASHDOWN	TANK 3B	HALAR	STL	ELECTRONIC
9H	TANK IN FLOOR -	0.1 (10)	NO ALARM	3 3/4 DIA x 2	AGENT SPILLS SPENT DECONS WASHDOWN	TANK 3B	HALAR	STL	ELECTRONIC
MEP									
10A	1 <sup>ST</sup> FLOOR TANK	3,848 (10)	NO ALARM	147 x 180 x 32	TANK NOT IN USE	--	CONC	--	NO SECONDARY CONTAINMENT
10B	1 <sup>ST</sup> FLOOR TANK	484	593	54 SQ x 55	NON-HAZARDOUS WASTES	BRINE DRYING AREA	CONC	--	NO SECONDARY CONTAINMENT
RSA									
11A	1 <sup>ST</sup> FLOOR TANK	80 (6)(8)	280	40 SQ x 55	HAZARDOUS WASTE SPILLS WASHDOWN SHOWER WATER SPENT DECONS	TMF STORAGE TANKS	HALAR	FRP	ELECTRONIC

TABLE 4-4  
(continued)

TANK NO. (1)	TANK LOCATION (1)	LIQUID CAPACITY GALLONS (2)	TANK SIZE INSIDE DIM INCHES (3)	TYPICAL WASTES	DESTINATION OF WASTES	MATERIALS OF CONSTRUCTION (4) INSIDE WETTED OUTSIDE	DETECTION METHOD FOR LEAK INTO SECONDARY CONTAINMENT (5)
12B	SAP UNDERGROUND TANK	800	1,000	NO DIAM AVAIL	LAB WASTES	PORTABLE TANK FPR/RES --	NO SECONDARY CONTAINMENT
13A	SHP ON GROUND TANK	320	400	60 SQ x 39	SHOWER WATER SPENT DECONS	PORTABLE TANK PE --	VISUAL
14A	ICI 1M FLOOR TANK	24(9)	30	24 SQ x 24	AGENT SPILLS SPENT DECONS WASHDOWN	TDI CONC/PT --	NO SECONDARY CONTAINMENT
14B	1M FLOOR TRENCH	87 (10)	NO ALARM	336 x 6 x 10	AGENT SPILLS SPENT DECONS WASHDOWN	TANK 14A CONC/PT --	NO SECONDARY CONTAINMENT
14C	1M FLOOR TANK	22	27	22 SQ x 34	SCRUBBER BRINE WASHDOWN	CALVERT SCRUBBER IN TDI STL/PT STL/PT	ELECTRONIC
15A	INZ 1M FLOOR TANK	308	625	52 SQ x 34	SPENT DECONS WASHDOWN	LIQUID INCIN., DEACTIVATION FURN., METAL PARIS FURN. OR BRINE DRYERS	ELECTRONIC
16A	UTL 1M GROUND TANK (OUTSIDE WITH COVER)	900 (10)	NO ALARM	60 SQ x 60	BOILER BLOWDOWN WATER (NON-HAZARDOUS WASTES)	SITE DRAINAGE SYSTEM CONC --	NO SECONDARY CONTAINMENT
6B	1M FLOOR TRENCHES	2,800 (10)	NO ALARM	24 x 125 FT x 11 TO 22	BOILER BLOWDOWN WATER (NON-HAZARDOUS WASTES)	TANK 16A CONC --	NO SECONDARY CONTAINMENT
6C	1M CONC PAD (OUTSIDE OPEN TOP)	65 (10)	NO ALARM	30 x 24 x 21	FUEL CIL SPILLS RAIN WATER (NON-HAZARDOUS WASTES)	55 GALLON DRUMS TO STORAGE AREA CONC --	NO SECONDARY CONTAINMENT

TABLE 4.4  
(continued)

**NOTES:**

- (1) SEE DRAWING TCDs 57-20 1-01, SHEET 1 OF 3
- (2) SEE FIGURE 1
- (3) SEE FIGURE 1. INSIDE DIMENSIONS DEFINED BYH. L & U
- (4) CONC - CONCRETE  
 FT - EPOXY PAINT  
 STL - LOW CARBON STEEL  
 FRP - FIBER REINFORCED PLASTIC  
 RES - RESIN  
 HALAR - FCFE PLASTIC  
 BAST - BASTELLOY  
 PE - POLYETHYLENE  
 PVDF - POLYVINYLIDENE FLUORIDE (KYNAR)  
 (5) ELECTRONIC - CONTINUOUS ELECTRONIC MOISTURE SENSOR  
 VISUAL - VISUAL INSPECTION, WITHIN 24 HOURS  
 (6) 200 GALLON RESERVE CAPACITY FOR SHOWERS.  
 (7) NO ALLOWANCE FOR 200 GALLONS OF SHOWER WATER.  
 PUMP TANK WHEN SHOWER IS OPERATING  
 (8) TANK PROVIDES SECONDARY CONTAINMENT FOR FACILITY  
 (9) SHOWER FOR EMERGENCY USE ONLY, WATER CONTAINED WITHIN  
 FLOOR AREA SECONDARY CONTAINMENT  
 (10) NO LEVEL SENSORS

**DEFINITIONS (ACCTR)**

"TANK" MEANS STATIONARY DEVICE, DESIGNED TO CONTAIN AN ACCUMULATION OF HAZARDOUS WASTE WHICH IS CONSTRUCTED PRIMARILY OF NON-EARTHEN MATERIALS (E.G., WOOD, CONCRETE, STEEL, PLASTIC) WHICH PROVIDE STRUCTURAL SUPPORT.

"TANK SYSTEM" MEANS A HAZARDOUS WASTE STORAGE TREATMENT TANK AND ITS ASSOCIATED ANCILLARY EQUIPMENT AND CONTAINMENT SYSTEM.

REFERENCE: ADAPTED FROM CAMDS ENGINEERING DIVISION  
 SHEET 54931, DRAWING NO. TCDs 57-201-0, DATED AUGUST 16, 1989.

R/USATHAMA/AA7

TABLE 4-5

Areas of Concern Identified at CAMDS

---

(3) Above-ground diesel fuel storage tanks  
Abandoned underground fuel line  
Underground fuel line  
Diesel fuel seep  
Petroleum underground storage tank  
Diesel underground storage tank  
(4) Above-ground raw material tanks

---

#### 4.1.3 Waste and Product Spill Areas

Waste and product spills have been noted at CAMDS. The primary releases were noted at the boiler blowdown discharge ditch and ponding area, the three diesel oil above-ground tanks areas (Areas of Concern), and the underground fuel oil product lines (an Area of Concern).

The boiler blowdown discharge ditch and ponding area are used to collect boiler blowdown water as well as water used for cooling of life support compressors. The blowdown and cooling water are discharged to the ground surface where it flows overland and ponds outside of the southern perimeter of the CAMDS facility. Discharge of water occurs on a continuous basis due to operation of life support compressors 24 hours a day (USATHAMA, 1988). Ponding of water has been observed during field work, indicating that a groundwater mound may exist. Sampling and analysis of the ponded water by EA Engineering, Science and Technology, Inc. (EA) detected the explosive compound 2,6-DNT (EA, 1988, RI, 1989).

The three diesel fuel tanks, each with a capacity of 30,000 gallons, are located within the western perimeter of CAMDS. Approximately 500 gallons of fuel was spilled on the ground surface in January 1978 and was reported to have been properly cleaned up in accordance with TEAD's Spill Prevention Control and Counter-Measure and Installation Spill Contingency Plans. Reportedly, sand was applied to the site to adsorb the oil which was taken to S-TEAD Demolition Grounds and burned (USATHAMA, 1988).

An underground spill (line leak) of diesel fuel reportedly occurred in the vicinity of the above ground tanks sometime between 1980 and 1985. The line leak went undetected for a period of time and an estimated 38,000 gallons of fuel were lost. The line leak was subsequently repaired (USATHAMA, 1988).

In January 1983, a diesel fuel spill of an unknown amount occurred from one of the three aboveground tanks. Three monitoring wells were in the area of the spill (EA, 1988). Floating product was found in two of the wells, and constituents of diesel fuel and explosives were found in the other. The extent of the diesel fuel plume was not determined. In December 1987, one of the monitoring wells was destroyed and a building foundation placed over its location. Groundwater is less than 10 feet from the surface at CAMDS (RI, 1989, USATHAMA, 1988).

According to information provided by TEAD Environmental Management Office, numerous other reported spills have occurred at CAMDS. A spill of sodium hydroxide occurred in a bermed area. The spill reportedly filled a gravel-lined berm to within three inches of the top. Between 1976 and 1981, an estimated 5,000 gallons of three to eighteen percent sodium hydroxide solution spilled into this bermed area. Another reported spill occurred in the 3X yard. A few square yards of soil were contaminated by a material containing seven percent potassium dichromate. This spill probably occurred within the past two years. In addition, chloroform and a small quantity of isopropyl alcohol were reported dumped down a sink in the Sample Analysis Facility (SAF) laboratory, which goes to the drain field (TEAD, 1988).

A soil sample from the 3X yard, near the SAF laboratory, was collected by TEAD Environmental Management Office personnel in 1988. The results for this sample are presented in Table 4-6. Chromium (70,000 ug/g), mercury (200 ug/g), cadmium (13.5 ug/g) and lead (37 ug/g) exceeded the estimated background range. Chromium, cadmium, lead, and mercury were also detected in the EP extract (RI, 1989).

Additional spills at the CAMDS Facility Area, primarily of petroleum hydrocarbons, are described in Table 4-7. Unless noted, the quantities are not known but are estimated to be greater than 50 gallons. The number of listed spills reported in 1988 is primarily due to better record keeping (RI, 1989).

#### 4.1.4 Nature and Extent of Contamination

##### 4.1.4.1 Data on Location and Extent of Contamination

A small number of chemical analyses had been performed at the CAMDS facility area previous to the RI field activities in 1988. The suspected contaminants, identified contaminants and extent of contamination for these previous studies are summarized in Table 4-8. A soil sample from the 3X yard near the SAF laboratory in the CAMDS facility was taken by TEAD environmental personnel and was analyzed for metals (Table 4-6). During the RI, a more extensive field investigation was performed in the CAMDS facility area. Surface water, surface soils, subsurface soils and groundwater samples were collected and analyzed for explosives, VOCs, BNAs, inorganics and petroleum hydrocarbons. Sampling locations are shown on Figures 4-4 and 4-5 and sampling frequency and analyses performed are summarized in Tables 4-9, 4-10, and 4-11.

##### Surface Water and Sediment Sampling Results

The results of the chemical analyses of surface water and sediment samples taken at the CAMDS Facility Area are presented in Tables 4-12 and 4-13, respectively.

The explosive compound 1,3,5-trinitrobenzene was detected at a concentration of 4.34 ug/L in the surface water sample SSW-CAM-01, located at the discharge point of the boiler blowdown. A previous study (EA, 1987) also detected the presence of nitroaromatics, 5.6 ppb of 2,6-DNT, during the PA/SI in the boiler blowdown discharge area. Nitroaromatics were not detected above analytical reporting levels in any other surface water or sediment sample taken from the CAMDS facility area (RI, 1989).

Volatile organics were detected at the boiler blowdown discharge point. A concentration of 6 ug/L of an unknown volatile organic compound was detected in the blowdown surface water sample (SSW-CAM-01). Another unknown volatile organic compound was also detected in the sediment sample (SSD-CAM-01) at a concentration of 0.917 ug/g. No volatile organic compounds were previously reported in the boiler blowdown runoff. No volatile organic compounds were detected above the analytical reporting levels in the surface water and sediment sample taken from the downgradient discharge area (RI, 1989).

Table 4-6

Analytical Results from a Soil Sample Collected at the  
3X Yard Near the SAF Laboratory, CAMDS Facility Area

Analyte	Soil Sample (ug/g)	EP Extract (mg/L)
Arsenic	11.7	<0.01
Barium	<20	<0.20
Cadmium	13.5	0.47
Chromium	70,000	2,300
Lead	37	0.40
Mercury	200	0.081
Selenium	<0.5	<.005
Silver	<1	<0.01

Source: TEAD (1988)

Table 4-7  
Spills at the CAMDS Facility Area

Location	Description	Year	Quantity
Main Tank Farm	Spilled during unloading of truck	1983	2,000 gallons
Main Tank Farm	Unloading procedures	1983 to present	Undetermined
3X yard	Leaking barrels	Startup to present	Undetermined
Day Tank (Underground Metal Parts Furnace)	Overfilled	Several times	Undetermined
Day Tank (Underground Metal Parts Furnace)	Hole(s) in tank	1988	Undetermined
Tank by DIR Trailer	Incorrect unloading procedures	1988	Undetermined
ADS Tank Farm	Leaking pipes, valves, etc. (small amounts but continuously over the years)	Startup to present	Undetermined
Day Tank (Deactivation Furnace)	Overfilled	Several times	Undetermined
Toxic Dunnage Incinerator Pollution Abatement System	Broken pipe	1988	Undetermined
Seg Area	Water left running in seg area. Water backed up and went over curb to outside of toxic area. Area of spill tested, no agent detected.	1988	100 gallons

Table 4-7 (Cont'd)  
Spills at the CAMDS Facility Area

Location	Description	Year	Quantity
PLO Shed	Used oil spilled on ground	1987	50 gallons
Lab Building 541	Suspected leak in piping to collection tank	1988	Undetermined

Source: RI, 1989.

Table 4-8

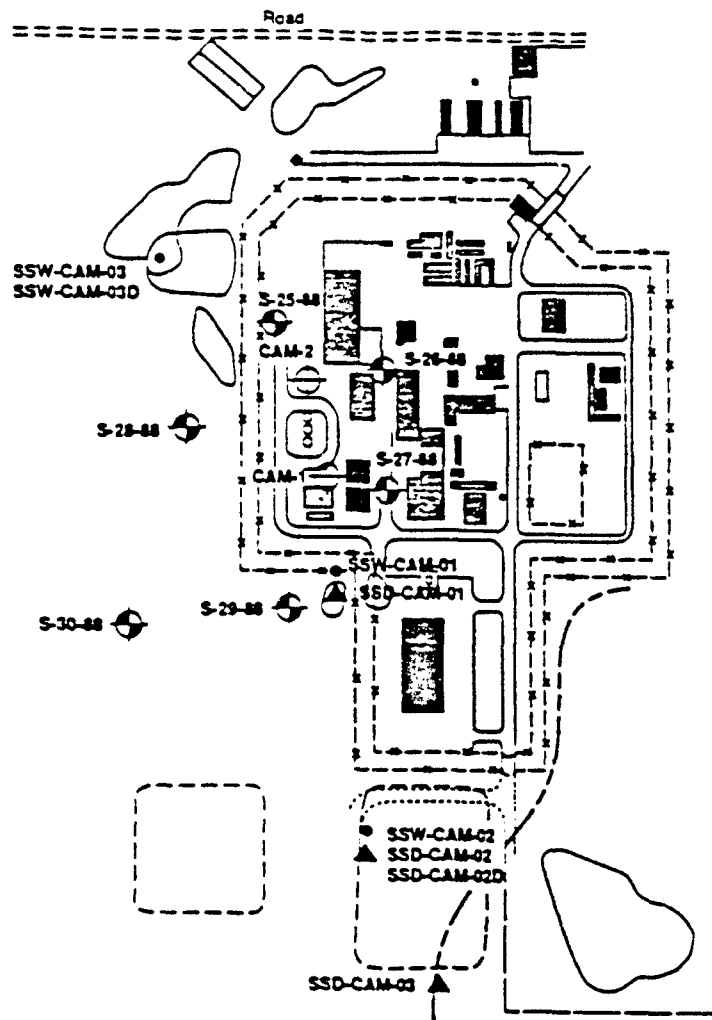
Contaminant Summary - CAMDS Facility Area  
Pre-RI

Suspected Contaminants	Identified Contaminants	Extent of Contamination
<u>Groundwater</u>		
Diesel Fuel From Tank Spill (includes degradation products and diesel fuels)	CAM-3 groundwater monitoring well (EA, 1987) - Eight semivolatile organic compounds were detected: naphthalene (100 ppb), 2-methylnaphthalene (200 ppb), acenaphthene (40 ppb), dibenzofuran (10 ppb), fluorene (20 ppb), phenanthrene (60 ppb), bis (2-ethylhexyl) phthalate (2 ppb), and anthracene (3 ppb). Volatile organic compounds benzene (20 ppb) and ethylbenzene (6 ppb) were detected at low levels.	Diesel fuel plume has migrated past well CAM-3. No wells down-gradient of CAM-3 have been installed, so extent of plume (including degradation products/constituents of diesel fuel) is unknown
Explosives	CAM-3 groundwater monitoring well - Explosive compound 2,4,6-TNT.	Extent of soil, subsurface and groundwater contamination of explosive compounds unknown.
Metals	CAM-3 groundwater monitoring well - Eight metals were detected. Only arsenic (430 ppb) exceeded Federal drinking water standards.	High concentrations of arsenic found throughout South area are suspected to result from naturally occurring deposits of metalloid (EA, 1988).
Gross Alpha and Beta Radionuclides	CAM-3 groundwater monitoring well - Gross alpha and beta radionuclides were detected. Gross alpha was twice primary drinking water standards.	Widespread occurrence of gross alpha and gross beta in groundwater at S-TEAD. Source may occur naturally.
Chemical Agent Breakdown Products	None detected.	Unknown. No contaminants were detected above the CRL.

Table 4-8  
(continued)

Suspected Contaminants	Identified Contaminants	Extent of Contamination
<u>Sediments</u>		
Explosives	No explosives found in samples taken.	Unknown.
<u>Surface Water</u>		
Explosives	2,6-DNT was found in the CAMDS boiler blowdown surface water discharge.	Unknown.

Adapted From RI, 1989



SCALE IS APPROXIMATE  
SOURCE: WESTON, VOL. 1, 1989

0 100 200  
SCALE: FEET

**Donohue**  
17283

**SEDIMENT, SURFACE WATER, AND GROUNDWATER  
SAMPLING LOCATIONS AT THE CAMDS FACILITY**



OCTOBER, 1989

**SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH**

Engineers • Architects • Scientists

**FIGURE 4-4**

Figure 4-5

Table 4-9

## CAMDS and Deactivation Furnace Areas

## RI Sample Location and Frequency

	Groundwater Samples From New Wells		Depth (ft)		Groundwater Samples From Existing Wells		Soil Borehole Chemical Analysis		Hand Auger Samples		Sediment Samples		Surface Water Samples	
	Proposed	Actual	Proposed	Actual	Proposed	Actual	Proposed	Actual	Proposed	Actual	Proposed	Actual	Proposed	Actual
MS	6	6	25-50	18.3-22	4 <sup>a</sup>	4	6 <sup>b</sup>	8 <sup>c</sup>	-	-	3	3	3	3
Deactivation Area	-	-	-	-	-	-	-	-	35	38 <sup>d</sup>	-	-	-	-

ating wells CAM-1, CAM-2, S-1, and S-3.

1 sample taken from screened depth of well.

Includes two samples each from S-27-88 and S-28-88.

Additional samples collected when extent of potential contamination was observed to be larger than anticipated. One additional sample was collected in the Hard Holding Area, and one additional hole (three depths) was sampled in the Deactivation Furnace Mercury Contamination Area.

ated from RI, 1989.

ATRAM/AB1

Table 4 10

## Summary of RI Field Sampling Program Conducted at CAMUS and Deactivation Furnace Areas

## Soil and Sediment Samples

Sample Matrix	Explosives	VOCs	SOCs	Metals	Breakdown Products <sup>a</sup>	Anions	Petroleum Hydrocarbons	Total and Depleted Uranium
Soils (wells) <sup>b</sup>	8 <sup>c</sup>	3 <sup>d</sup>	4 <sup>e</sup>	—	—	8 <sup>c</sup>	7 <sup>f</sup>	—
Sediment <sup>g</sup>	3	3	3	—	—	3	3	—
Soil (stained area) <sup>h</sup>	9	9	9	—	—	—	—	—
Soil (mercury spill) <sup>j</sup>	22	—	—	22 <sup>j</sup>	—	—	—	—
Soil (fuel spill) <sup>k</sup>	4	4	4	—	—	—	4	—

lignyl and isopropyl methyl phosphoric acid. Thiodiglycol only at Mustard Holding Area.

<sup>a</sup> S-25-88, S-26-88, S-27-88, S-28-88, S-29-88, and S-30-88.

<sup>b</sup> See two sample depths from S-27-88 and S-28-88.

<sup>c</sup> S-25-88, S-26-88 and S-30-88 only.

<sup>d</sup> es did not reach laboratory and therefore could not be analyzed.

<sup>e</sup> S-26-88, S-28-88 (two sample depths), S-29-88, and S-30-88.

<sup>f</sup> es SSO-CAM-01, -02, and -03.

<sup>g</sup> es SSO-01 through -09.

<sup>h</sup> es SSO-01 through -22.

<sup>i</sup> only.

<sup>j</sup> es SSO-01 through -04.

<sup>k</sup> d from RI, 1989.

NAME/AB1

Table 4-11

## Summary of RI Field Sampling Program Conducted at CAMUS

## Aqueous Samples

Sample Matrix	Explosives	VOCs	SOCs	Metals <sup>a</sup>	Breakdown Products <sup>b</sup>	Anions	Petroleum Hydrocarbons	Total and Depleted Uranium	Gross Alpha and Gross Beta
Groundwater <sup>c</sup>	10	9 <sup>d</sup>	10	10	10 <sup>e</sup>	10	10	10	10
Surface Water <sup>f</sup>	3	3	3	—	—	3	48	—	3

tered and unfiltered.

edilglycol and isopropyl methyl phosphoric acid.

. S-3, CAM-1, CAM-2, S-25-88, S-26-88, S-27-88, S-28-88, S-29-88, S-30-88

holding time for VOCs was exceeded for samples from S-1 in the CAMUS Facility Area

plus not analyzed for thiodiglycol.

-CAM-01, -02, and -03.

licate sample of SSU-CAM-03.

ted from RI, 1989.

17RANA/AB1

Table 4-12

## Analyses of Surface Water Samples from the CAMDS Facility Area

Parameter		Sample Designation			
		SSW-CAM-01	SSW-CAM-02	SSW-CAM-03	SSW-CAM-03D
		Concentrations in ug/L			
Semivolatile	UNK 579	--	--	--	10
Organics	UNK 584	10	--	--	--
	UNK 592	--	--	--	30
	UNK 593	--	--	--	3
	UNK 594	--	--	--	7
	UNK 599	5	30	--	2
	UNK 600	--	100	--	50
	UNK 601	--	6	10	--
	UNK 647	--	50	--	--
	UNK 679	—	30	--	--
Volatile Organics	UNK 147	6	--	--	--
Explosives	1,3,5-Tri-nitrobenzene	4.34	LT	LT	LT
Petroleum Hydrocarbons		7,000	3,900	1,800	320
Anions	Bromide	20.7	24.3	62.5	62.3
	Chloride	41,780	53,300	79,640	72,470
	Fluoride	LT	LT	LT	LT
	NO <sub>2</sub> -NO <sub>3</sub>	LT	LT	8,690	LT

Notes: -- Analyte not detected.

LT or Blank Below CRL, SRL, or stated value.

Source: RI, 1989.

Table 4-13

## Analyses of Sediment Samples from the CAMDS Facility Area

Parameter	Sample Designation			
	SSD-CAM-01	SSD-CAM-02	SSD-CAM-02D	SSD-CAM-03
	Concentrations in ug/g			
<u>Volatile Organics</u>				
UNK 126	0.917			
<u>Semivolatile Organics</u>				
UNK 571	6 <sup>a</sup>			
UNK 572	3 <sup>a</sup>			
UNK 578	4 <sup>a</sup>			
UNK 580				
UNK 581	9 <sup>a</sup>			
UNK 584				1 <sup>a</sup>
UNK 587	3 <sup>a</sup>			
UNK 588	0.5 <sup>a</sup>			
UNK 589	7 <sup>a</sup>			
UNK 590	10 <sup>a</sup>			7 <sup>a</sup>
UNK 591				4
UNK 594		0.8 <sup>a</sup>		
UNK 596				6 <sup>a</sup>
UNK 598				1 <sup>a</sup>
UNK 599	10 <sup>a</sup>			10 <sup>a</sup>
UNK 601		0.4 <sup>a</sup>		
UNK 602		0.5 <sup>a</sup>		
UNK 603		0.4 <sup>a</sup>		4
UNK 604		0.6 <sup>a</sup>		5 <sup>b</sup>
UNK 605				1 <sup>a</sup>
UNK 606		0.8 <sup>a</sup>		
UNK 608	10 <sup>a</sup>	0.4		10 <sup>a</sup>
UNK 609	4 <sup>a</sup>	0.7 <sup>a</sup>		
UNK 612				6 <sup>a</sup>
UNK 613				1
UNK 614	8 <sup>a</sup>			
UNK 615		2 <sup>a</sup>		3 <sup>a</sup>
UNK 616	4 <sup>a</sup>	1		20 <sup>a</sup>
UNK 617				6 <sup>a</sup>
UNK 618		0.7		
UNK 623	5 <sup>a</sup>	2 <sup>a</sup>		10 <sup>a</sup>
UNK 624				10 <sup>a</sup>
UNK 625				5 <sup>a</sup>
UNK 628	10	3 <sup>a</sup>		

Table 4-13  
(continued)

Parameter	Sample Designation			
	SSD-CAM-01	SSD-CAM-02	SSD-CAM-02D	SSD-CAM-03
	Concentrations in ug/g			
UNK 629		10 <sup>a</sup>		
UNK 632		5 <sup>a</sup>		
UNK 633		5 <sup>a</sup>		
UNK 637			1 <sup>a</sup>	
UNK 639			0.5 <sup>a</sup>	0.3
UNK 644			0.7 <sup>a</sup>	
UNK 647			0.5 <sup>a</sup>	
UNK 648			0.5 <sup>a</sup>	
UNK 649			0.5 <sup>a</sup>	
UNK 656			0.5 <sup>a</sup>	
UNK 659				1
UNK 664		4		
UNK 671		7		
<u>Petroleum Hydrocarbons</u>	13,000	12,000	2,100	18
<u>Anions</u>				
Bromide	LT 2,500	LT 2,500	LT 2,500	LT 2,500
Chloride	LT 2,500	LT 2,500	LT 2,500	LT 2,500
Fluoride	17.2	17.5	36.8	25.4
Nitrate/Nitrite	307	LT 9,560	LT 9,560	LT 9,560

<sup>a</sup>Alkane.

<sup>b</sup>Trimethyl naphthalene.

Note: LT or Blank - Below CRL, SRL, or stated value.

Source: RI, 1989

Unknown semivolatile organic compounds (SOCs) were detected at all three surface water locations and at two of the three sediment sampling locations. Surface water and sediment from the boiler blowdown discharge area contained the highest levels of total SOCs (216 ug/L in SSW-CAM-02, 17 ug/L in SSW-CAM-02D, and 124.5 ug/g in SSD-CAM-02). Most of the SOCs were tentatively identified as alkanes, which is indicative of fuel contamination. Fewer SOCs were detected in surface water at the boiler blowdown discharge point (15 ug/L in SSW-CAM-01), and none were detected in the sediment at this location. This distribution of contaminants suggests that SOCs in the blowdown discharge area are due to past (but not present) discharges (RI, 1989).

Unknown SOCs were also detected in duplicate surface water samples from the sewage effluent pit (10 ug/L in SSW-CAM-03, 102 ug/L in SSW-CAM-03D). A sediment sample from a ditch draining from the CAMDS Facility Area (SSD-CAM-03) contained unknown SOCs totaling 111 ug/g. Again, the tentative identification of most of these unknowns as alkanes suggests fuel contamination (RI, 1989).

Fluoride was found in the sediments of the blowdown discharge point (17.2 ug/g), the discharge area (17.5 and 36.8 ug/g), and the sewage effluent pit (25.4 ug/g). No fluoride was detected above the analytical reporting levels in any surface water samples taken (RI, 1989).

The detection level used for the NO<sub>2</sub> + NO<sub>3</sub>-nitrogen in water samples is 5,000 ug/L. A surface water sample collected during the PA/SI detected NO<sub>2</sub> + NO<sub>3</sub>-nitrogen at 840 ug/L at the boiler blowdown discharge point. A background surface water sample taken from Faust Creek (SSW-07) in the southwest corner of S-TEAD also showed the NO<sub>2</sub> + NO<sub>3</sub>-nitrogen levels to be less than detection (5,000 ug/L). Nitrate/nitrite also was detected in SSD-CAM-01 (307 ug/g) (RI, 1989).

NO<sub>2</sub> + NO<sub>3</sub>-nitrogen was detected in a surface water sample (SSW-CAM-03) at a concentration of 8,690 ug/L, but was below the detection level of 5,000 ug/L in the duplicate sample (SSW-CAM-03D). The higher concentration detected in the surface water sample indicated elevated NO<sub>2</sub> + NO<sub>3</sub>-nitrogen concentration from the sanitary wastewater. Because no explosives were detected in the lagoon, it is not likely that the levels of NO<sub>2</sub> + NO<sub>3</sub>-nitrogen are due to the breakdown of explosives (RI, 1989).

Elevated concentrations of petroleum hydrocarbons were detected in the sediment of the blowdown discharge point and the discharge collection area at concentrations of 13,000 ug/g in SS-CAM-01, 12,000 ug/g in SSD-CAM-02, and 2,100 ug/g in SSD-CAM-02D. Petroleum hydrocarbons were detected in the surface water at the discharge point and the collection area at concentrations of 7 mg/L and 3.9 mg/L, respectively. Petroleum hydrocarbons were also detected at 1.8 mg/L and 0.32 mg/L in the duplicate sample from the old sewage lagoon. The source of this contamination is either shallow groundwater, which was contaminated by the past diesel fuel spill, or direct discharge to the lagoon (RI, 1989).

The results of the sample analysis of the sediment sample (SSD-CAM-03) taken from the drainage channel that receives surface water runoff from the site indicated the presence of petroleum hydrocarbons at a concentration of 18 ug/g. The source of the petroleum hydrocarbons is most likely due to past spills at the CAMDS facility area and the migration of these contaminants via stormwater runoff (RI, 1989).

#### Subsurface Soil Sampling Results

Semivolatile organic compounds (SOCs) were found in all eight subsurface soil samples (Table 4-14). S-30-88 contained the highest total SOC concentration (41.9 ug/g). 1,1-Dimethyl hydroperoxide (29.54 ug/g), a benzenedicarboxylic acid ester (0.28 ug/g), and ketone (2.58 ug/g) were tentatively identified in the sample.

Multiple SOCs were detected in most of the subsurface soil samples collected from boreholes closest to the main tank farm and buildings. S-27-88-03 (10-foot depth) contained the polynuclear aromatic hydrocarbons (PAHs) phenanthrene (0.88 ug/g), naphthalene (0.55 ug/g), fluorene (0.21 ug/g), and acenaphthene (0.16 ug/g), indicative of fuel-contaminated soil. S-27-88-07, collected at a 15-foot depth, contained none of these PAHs, although 1.4 ug/g of an unknown SOC was detected. Two ketones, two xylenes, and two unknown SOCs totaling 2.5 ug/g were detected in S-25-88-08. Four compounds (primarily alkanes) totalling 1.1 ug/g were found in S-26-88-01.

Downgradient of the CAMDS, S-28-88-05 (12.5-foot depth) contained 8.1 ug/g of alkanes, 9 ug/g of an organic acid, and 0.8 ug/g of an unknown compound. S-28-88-07 (15-foot depth) also contained alkanes (4.3 ug/g) and an organic acid (5 ug/g), as well as dimethyl naphthalene (0.1 ug/g), but indicated a decrease in SOC contamination with depth. S-29-88-04 contained 10 ug/g of an organic acid.

Petroleum hydrocarbons were detected in all subsurface soil samples at the CAMDS with the highest levels in S-27-88-03 at a 10-foot depth (380 ug/g), S-28-88-05 at a 12.5-foot depth (70 ug/g) and S-25-88-06 at a 16-foot depth (25 ug/g), with concentrations between 2.0 and 9.0 ug/g for the remaining samples. It appears that contaminants from past fuel spills have migrated via groundwater from the CAMDS facility area toward S-28-88. As the water table seasonally rises and falls, a portion of the petroleum hydrocarbons would tend to adsorb to soil particles above the average water table elevation. Volatile organics were found only in S-27-88-07 (10 ug/g, tentatively identified as xylenes) and in S-28-88-07 (11 ug/g, unknown VOC) (RI, 1989).

Compounds used in explosives were not detected in subsurface soil samples. Chloride ranged from below the detection limit in S-30-88 to 65,000 ug/g in S-28-88-07. Fluoride ranged from below the detection limit in S-27-88-01 to 28.2 ug/g in S-26-88-01. Sulfate was detected in three of the eight subsurface soil samples. Bromide and nitrate/nitrite were not detected in subsurface soil samples from the CAMDS area.

Table 4-14

Analyses of Soil Boring Samples from the CAMUS Facility Area

Parameter	S-25-88-08	S-26-88-01	S-27-88-03	S-27-88-07	S-28-88-05	S-28-8807	S-29-88-04	S-30-88
	Concentrations in ug/g							
Depth (ft)	16	19	10	15	12.5	15	19	13
<u>Volatile Organics</u>								
UNK 110						11		
UNK 126 (Xylenes)				10				
<u>Semivolatile Organics</u>								
Acenaphthene			0.16					0.96
Di-n-Butyl Phthalate			0.7					1.94
Fluorene			0.21					3.73
Naphthalene			0.55					2.53
Phenanthrene			0.88					0.38
UNK 510 (Xylenes)	1.0							
UNK 531 (Ketone) <sup>b</sup>	0.6							
UNK 532 (Ketone) <sup>b</sup>	0.3							
UNK 550	0.2							
UNK 552								
UNK 553								
UNK 562								
UNK 563								
UNK 564								
UNK 579								
UNK 590								
UNK 593		0.2 <sup>a</sup>			0.8	0.08		
UNK 594					1.0 <sup>a</sup>	0.2 <sup>a</sup>		
UNK 595		0.1 <sup>a</sup>			1.0 <sup>a</sup>	0.6 <sup>a</sup>		
UNK 596					0.6 <sup>a</sup>	0.1 <sup>c</sup>		
UNK 598					9 <sup>d</sup>	0.3 <sup>a</sup>	10 <sup>d</sup>	
UNK 599					0.9 <sup>a</sup>	0.2 <sup>a</sup>		
UNK 600		0.2 <sup>a</sup>			0.6 <sup>d</sup>	5 <sup>d</sup>		
UNK 601				1.4	0.9 <sup>a</sup>	0.5 <sup>a</sup>		
UNK 602					0.7 <sup>a</sup>	0.2 <sup>a</sup>		
UNK 603	0.4					0.2		
UNK 607					1.0 <sup>a</sup>	0.6 <sup>a</sup>		0.23
UNK 608					1.0 <sup>a</sup>	0.6 <sup>a</sup>		0.20

Table 4-14

Analyses of Soil Boring Samples from the CAMDS Facility Area  
(continued)

Parameter	S-25-88-08	S-26-88-01	S-27-88-03	S-27-88-07	S-28-88-05	S-28-8807	S-29-88-04	S-30-88
	Concentrations in ug/g							
<u>Semivolatile Organics (cont.)</u>								
UNK 609						0.1 <sup>a</sup>		0.25
UNK 611						0.2 <sup>a</sup>		
UNK 612					0.4 <sup>a</sup>	0.2 <sup>a</sup>		
UNK 615								
UNK 627		0.6						
BDAE								0.28
Dimethyl Hydroperoxide								29.54
Ketone <sup>b</sup>								2.58
<u>Explosives</u>								
Petroleum Hydrocarbons	25	11	380	2.0	70	2.0	4.0	9.0
<u>Anions</u>								
Bromide	LT	LT	LT	LT	LT	LT	LT	LT
Chloride	12,900 <sup>a</sup>	10,300	14,500	21,400	20,300	65,000	6,640	LT
Fluoride	4.39	28.2	LT	21.1	25.5	24.8	23.3	11.2
Nitrite/Nitrate	LT	LT	LT	LT	LT	LT	1.160	LT
Sulfate	19,150 <sup>a</sup>	55,300	LT	LT	33,100	LT	LT	LT

<sup>a</sup>Alkane.<sup>b</sup>A ketone was also found in a blank sample at a concentration of 1.0 ug/g.<sup>c</sup>Dimethyl naphthalene.<sup>d</sup>Organic acid.

Notes: LT or Blank - Below CRL or SRL.

Samples analyzed for all parameters shown unless noted by NA.

Depths are to top of sample. Samples collected over a 1.5-foot range.

BOAE - Unknown benzenedicarboxylic acid ester derivative.

<sup>a</sup>Average of laboratory duplicates.

Source: RI, 1989.

R/USATHANA/AB8

### Groundwater Sample Results

Sampling results are based on analyses for ten monitor wells in close proximity to the CAMDS facility (Figure 4-5). Results are listed in Table 4-15.

The level of petroleum hydrocarbons (190,000 ug/L) at CAM-1 was approximately two orders of magnitude greater than in most other wells, evidence of the remains of past fuel spills. In 1987, floating fuel product prevented sampling at this well and at CAM-2 (EA, 1983). Total concentrations of explosives (30 ug/L of 2,4,6-trinitrotoluene) and SOC's (646 ug/L) were also highest in CAM-1. Naphthalene (79.6 ug/L) was the only SOC conclusively identified in the sample, while alkanes and naphthalene derivatives were tentatively identified. Other PAHs found in the soil boring sample collected in the CAMDS area did not appear in the groundwater results. The VOC, benzene, was detected at 41.9 ug/L.

The other wells inside the CAMDS area fence also contained evidence of past fuel spills. In decreasing overall organic contaminant levels, the wells were CAM-1, CAM-2, S-25-88, S-26-88, and S-27-88. Naphthalene was detected in all five wells in this area (67.5 to 122 ug/L). Methylated benzenes and methylated naphthalenes were tentatively identified compounds common among all the wells. Volatile organic compounds were detected in S-27-88 (17 ug/L carbon tetrachloride), S-25-88 (4.51 ug/L benzene, 69 ug/L carbon tetrachloride, and 9.01 ug/L trichloroethylene (TCE)), and S-26-88 (17 ug/L TCE). 2,4,6-Trinitrotoluene was found in four of the five wells at concentrations from 1.65 ug/L to 30 ug/L. Except for less than 1 ug/L of 2,4-dinitrotoluene detected in S-26-88, no other explosives were detected. The chemical agent breakdown product, IMPA, was detected in three of the five wells at concentrations of 30 ug/L (CAM-2), 27 ug/L (CAM-1), and 15 ug/L (S-27-88) (RI, 1989).

Except for CAM-1, the petroleum hydrocarbon concentrations ranged from 5,400 ug/L to 8,500 ug/L in this area. Petroleum hydrocarbons have been found in background well 1 at concentrations of 1,700 ug/L to 3,100 ug/L, indicating some natural hydrocarbons. However, hydrocarbon concentrations from wells around the CAMDS facility suggest fuel contamination specific to the facility area (RI, 1989).

Arsenic and nickel were present at concentrations exceeding background levels in all wells in both the total and dissolved forms. Total silver, dissolved copper, dissolved lead, and either total or dissolved antimony concentrations also exceeded the background ranges for these metals in each of the wells at the CAMDS facility area. The dissolved selenium concentrations in S-27-88 exceeded the background range (RI, 1989).

Although arsenic does occur naturally in soil and groundwater in this region (0 to 8.8 ug/L estimated background range for groundwater), arsenic concentrations are generally one order of magnitude higher in groundwater at the CAMDS area than downgradient of the CAMDS area. Concentrations greater than 1,000 ug/L were found at S-25-88, S-27-88, and CAM-2. The greatest nickel concentrations were detected at CAM-1 (176 ug/L dissolved nickel) and S-25-88 (175 ug/L dissolved nickel), which are approximately eight times the highest detected background concentration (RI, 1989).

Table 4-15

## Analyses of Groundwater Samples from the CAMDS Facility Area

Parameter	Sample Location						
	Within CAMDS			Outside CAMDS			
	CAM-1	CAM-1	S-25-88 S-26-88 S-27-88 Concentrations in ug/l or as noted	S-28-88 S-29-88 S-30-88	S-1	S-3	
<b>Volatiles Organics</b>							
Benzene	41.9		4.51				
Carbon Tetrachloride			69				
Trichloroethylene			9.01	17			
UNK 116			0.801				
<b>Semi-volatile Organics</b>							
Naphthalene	79.6	98.7	67.5	89	122	50.1	
UNK 587						36	
UNK 588					4 <sup>b</sup>	13	
UNK 589		10			12 <sup>b</sup>	5	
UNK 590		25					
UNK 591	106 <sup>e</sup>		14 <sup>b</sup>	6 <sup>e</sup>			
UNK 592	25 <sup>e</sup>	39 <sup>e</sup>	17 <sup>e</sup>	23 <sup>d</sup>	5 <sup>d</sup>	17 <sup>e</sup>	
UNK 593	57 <sup>e</sup>	57 <sup>e</sup>	34 <sup>e</sup>	19 <sup>e</sup>	32 <sup>e</sup>		
UNK 594	11 <sup>a</sup>	110 <sup>e</sup>	9 <sup>d</sup>	7 <sup>d</sup>	12 <sup>d</sup>	17	
UNK 595	17	44 <sup>e</sup>	18 <sup>e</sup>	6	43 <sup>e</sup>	30	
UNK 596	33 <sup>e</sup>	43 <sup>b</sup>	33 <sup>b</sup>	26 <sup>b</sup>	63 <sup>b</sup>	8	
UNK 597	10	19 <sup>a</sup>	61 <sup>e</sup>	31 <sup>e</sup>	12 <sup>e</sup>	5	
UNK 598	26 <sup>e</sup>		24	6 <sup>e</sup>	100 <sup>e</sup>		
UNK 599		21 <sup>e</sup>	5 <sup>e</sup>	9 <sup>e</sup>			
UNK 600		18 <sup>c</sup>	2 <sup>e</sup>	1 <sup>f</sup>			
UNK 601	8	8	5 <sup>b</sup>	7	7	11	
UNK 602	15	12 <sup>a</sup>	7 <sup>e</sup>	6		18	
UNK 603	12	11	24 <sup>b</sup>		51 <sup>b</sup>	6	
UNK 604	51	19 <sup>e</sup>	7 <sup>b</sup>				
UNK 605	11		7 <sup>b</sup>				
UNK 606	13 <sup>e</sup>	12	9 <sup>b</sup>				
UNK 607	14		15				
UNK 608		19 <sup>a</sup>					
UNK 609	15						
UNK 610							
UNK 611	21		11		18 <sup>b</sup>	7	
					20		

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10

NA

Table 4.15

Analyses of Groundwater Samples from the CAMDS Facility Area  
(continued)

Parameter	Sample Location									
	CAM-1	CAM-1	Within CAMDS				Outside CAMDS			
			S-25-88	S-26-88	S-27-88	S-28-88	S-29-88	S-30-88	S-31	S-3
Concentrations in ug/l or as noted										
<b>Semi-volatile Organics (cont.)</b>										
UNE 612				3 <sup>a</sup>						
UNE 613						5				
UNE 615				3	19 <sup>b</sup>					
UNE 617				23 <sup>b</sup>	4					
UNE 619				38	19 <sup>a</sup>	5				
UNE 621	46 <sup>a</sup>	41	35 <sup>c</sup>			150				
UNE 693	20									
UNE 794	54									
		12 <sup>d</sup>								
<b>Explosives</b>										
2,4-Dinitrotoluene				0.88						
1,3,5-Trinitrobenzene						9.8				
2,4,6-Trinitrotoluene	30	20	1.65	2.57		14	5.27	3.15		3.25
MPA	27	30	LT	LT	15	15	18	11	16	13
Petroleum Hydrocarbons	190,000	8,500	5,600	5,600	5,400	3,700	1,800	1,200		560
<b>Metals - Total/Dissolved</b>										
Silver	0.426/0.426	0.319/0.426	0.319/LT	0.319/0.426	0.426/0.639	1.38/0.53	0.53/0.43	0.71/2.66		0.74/0.74
Arsenic	720/590	1,100/1,500	1,300/1,100	490/370	1,500/1,600	370/370	410/470	72/150	320/330	20.9/17.5
Beryllium						0.201/LT		1.0/LT	0.503/LT	
Cadmium								6.44/LT		
Chromium						1,600/1,900				
Copper	6.22/27.9	5.36/18.5	14.5/13.9	5.25/8.90	7.93/8.36	18.5/7.72	17.6/LT	36.1/12.21	10.9/14.5	10.3/3/32
Nickel	46.7/176	58.3/80.6	78.3/175	42.5/42.4	63.2/33.1	23.1/LT	12.5/LT	16.0/LT	12.4/LT	
Lead	6.57/15.8	4.25/4.95	3.13/4.15	2.73/2.73	7.28/7.68	11.9/LT	7.58/LT	9.91/LT	12.4/LT	2.73/LT
Antimony	8.07/4.89	5.57/LT	10.7/4.43	7.05/LT	5.80/4.55	10.6/3.98	8.64/LT	9.09/8.18		6.48/LT
Selenium					LT/40.8					
Thallium										
Zinc	48.7/69.0	28.8/84.7	31.3/41.3	19.7/LT	18.8/46.0	127/LT	72.2/LT	82.0/23.3	35.2/96.0	69.9/19.1

Table 4-15

Analyses of Groundwater Samples from the CAMDS Facility Area  
(continued)

Parameter	Sample Location						
	Within CAMDS		Outside CAMDS				
	CAM-1	S-25-88	S-26-88	S-27-88	S-28-88	S-29-88	S-30-88
		Concentrations in ug/l or as noted					
<b>Inorganics mg/L</b>							
Bromide	LT	LT	LT	LT	LT	LT	LT
Chloride	969	1,780	237	927	3,950	1,560	7,830
Nitrate/Nitrite	LT	LT	LT	16	LT	LT	27,000
Sulfate	3,300	1,720	2,050	4,800	4,800	2,490	4,200
Fluoride	NA <sup>a</sup>	NA	NA	NA	NA	NA	NA
<b>Radionuclides pCi/L</b>							
Gross Alpha	LT58	51±33	39±36	130±70	LT 86	LT 54	210±130
Gross Beta	59±29	48±22	30±16	92±39	79±39	56±29	140±70
Uranium	26	19	23	41	29	18	18

<sup>a</sup>Alkane.<sup>b</sup>Benzene or methylated benzene.<sup>c</sup>Decane.<sup>d</sup>Dihydro-methyl-1H-1,2-diene.<sup>e</sup>Naphthalene or methylated naphthalene.<sup>f</sup>Pyrrilo pyrimidine.<sup>g</sup>MA = Not AnalyzedNotes: <sup>a</sup> - Average of laboratory duplicates.

Samples analyzed for all parameters shown unless noted by NA.

LT or Blank - Below CRL, SRL, or stated value.

Source: RI, 1989.

R/USATHANA/AB9

The highest levels of gross alpha, gross beta, and uranium were detected in S-27-88. Almost all groundwater samples from this area of the CAMDS facility area contained some level of uranium and gross alpha and gross beta activity. The levels were slightly greater than those found at CAM-3 in 1987. Radioactive materials are not known to be used at CAMDS (RI, 1989).

Chloride and sulfate were found above background levels in all wells from this area of CAMDS, while nitrate-nitrite and bromide did not exceed background in any of the wells. Chloride and sulfate constitute a major component of total dissolved solids (TDS), which is often used to categorize potential drinking water. Considering only the chloride and sulfate components of TDS, groundwater within the CAMDS facility area contained an average of 3,426 mg/L (geometric mean), which indicates brackish limited water use (RI, 1989).

#### 4.1.4.2 Potential Impacts to Human Health and Environment

Chemicals of potential concern to human health and the environment are defined as those chemicals present at the CAMDS facility area because of facility activities and include only those chemicals detected at concentrations above naturally occurring levels which are not associated with sampling or laboratory artifacts. Based upon this criterion, the following chemicals of potential concern were identified for surface water, sediment, subsurface soils and groundwater in the CAMDS facility area:

Surface water:	1,3,5-trinitrobenzene and petroleum hydrocarbons.
Sediment:	fluoride and total petroleum hydrocarbons.
Subsurface Soils:	Organics-Di-n-butyl phthalate, petroleum hydrocarbons, PAHs (acenaphthene, fluorene, naphthalene, phenanthrene). Inorganics - chloride, fluoride, nitrate-nitrite, sulfate.
Groundwater:	Organics - benzene, carbon tetrachloride, trichloroethene, naphthalene, petroleum hydrocarbons, 2,4-dinitrotoluene, isopropylmethylphosphonic acid (IMPA), 1-3-5-trinitrobenzene, 2-4-6-trinitrotoluene. Inorganics - chloride, sulfate, antimony, arsenic, nickel, lead, uranium. Ionizing radiation - gross alpha, gross beta.

Physiochemical properties of organic compounds influence transport process. These include such properties as solubility in water, vapor pressure, Henry's Law constant,  $K_{oc}$  and  $K_{ow}$ . Properties which influence migration of inorganic chemicals include site-specific external factors such as medium pH, cation exchange capacity of soil, presence of humic material or microbes, oxidizing or reducing conditions, etc. (RI, 1989).

Potential impacts to human health and the environment are considered as off-site (outside of the fenced S-TEAD installation boundary) and on-site (within the fenced facility). The off-site discussion is identical for both the CAMDS

and the Deactivation Furnace Mercury Contamination areas. The on-site potential impacts are discussed for the CAMDS and Deactivation Furnace Mercury Contamination separately. A conceptual exposure model is presented in Figure 4-6 for the CAMDS.

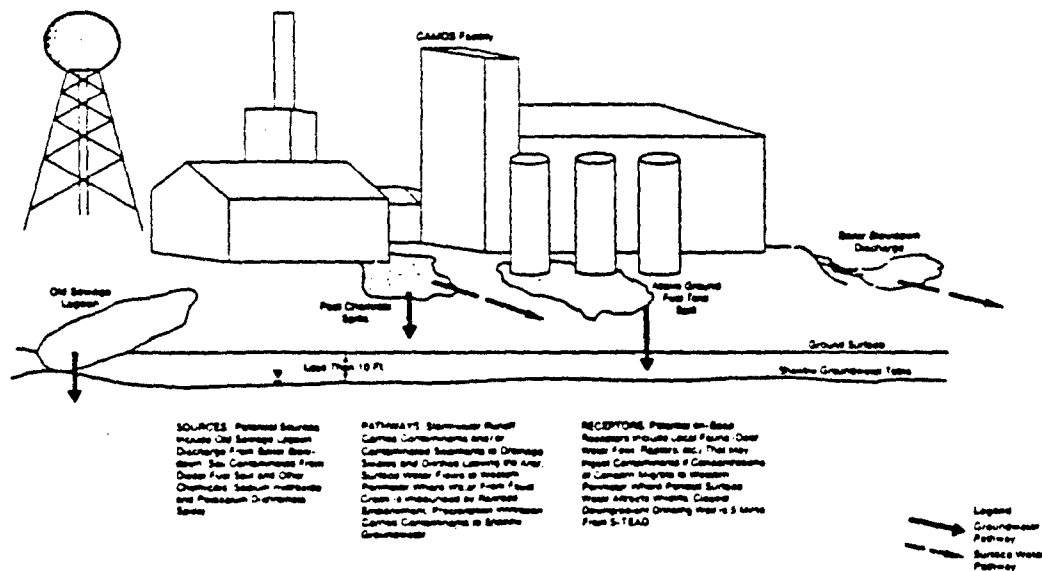
#### Off-Site Exposure Impacts

The entire off-site area surrounding S-TEAD is zoned as "Multiple Use 40", and is intended as a low-density zone with limited human habitation, public utility and service requirements. Consequently, surrounding land around S-TEAD is undeveloped and used chiefly for sheep and cattle grazing. Small communities are located two to ten miles northeast and northwest of S-TEAD and the CAMDS facility (RI, 1989, USATHAMA, 1988).

The exposure of residents of the area to chemicals that have migrated off-site is considered unlikely for the following reasons. Off-site exposure to chemicals in surface water is unlikely because surface water from the site generally drains to the ponded area near the western perimeter where off-site migration is retarded by railroad embankments that extend along the entire western edge and part of the north-central portion of S-TEAD. Exposure to chemicals of potential concern that migrate off-site in air is considered unlikely because chemical concentrations in surface soil and surface water at the site are low enough so that dispersion of chemicals from the S-TEAD study areas to area residents would likely result in negligible exposure point concentrations (RI, 1989, USATHAMA, 1988).

Off-site residential exposures to chemicals migrating in groundwater also are unlikely to occur under current land use conditions. Groundwater movement at S-TEAD is affected by a groundwater divide that cuts diagonally across the site in a southwest to northeast direction (see Figure 3-4). Groundwater south of the divide flows from the site in a south-southeast direction. There are no towns within approximately 15 miles of S-TEAD in this direction, and the nearest town obtains its water from an aquifer different than the one at S-TEAD. (Scattered residences may occur in this direction, but this is not known based on the available information.) Groundwater north of the divide flows in a northwest direction towards Rush Valley. Once the groundwater reaches the valley, it flows directly north towards the Stockton Bar, approximately ten miles north, and eventually reaches the Great Salt Lake (RI, 1989, USATHAMA, 1988).

There are no towns located between the area where the groundwater leaves S-TEAD and enters Rush Valley or between this portion of the Rush Valley and the Stockton Bar. The towns of St. John, Onaqui, and Clover are located northwest of the location where groundwater from S-TEAD enters Rush Valley and thus, are not in the direction of groundwater flow. The nearest possible groundwater exposure point known to exist is a small restaurant located approximately 5 miles to the north of S-TEAD. (Again, it is possible that scattered residences may occur between S-TEAD and N-TEAD in the direction of groundwater flow, but this is not known based on the available information.) Because of the large distance between the restaurant and the S-TEAD, it is likely that the concentrations of any chemicals of potential concern migrating from the western perimeter would be greatly reduced (by dispersion and dilution process) before reaching the area of the restaurant (RI, 1989).



SOURCE: WESTON, VOL. I, 1989

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OCTOBER, 1989

**CONCEPTUAL EXPOSURE MODEL  
CADMS FACILITY AREA  
SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH**

Engineers • Architects • Scientists

FIGURE 4-6

Terrestrial vegetation, wildlife, birds, waterfowl and aquatic life are potentially exposed to chemicals in surface soils, surface waters and sediments. Vegetation and wildlife will not be exposed to chemicals of potential concern in subsurface soils or groundwater because these media are not accessible to the potential receptors. Exposure to chemicals by off-site terrestrial vegetation and wildlife is generally confined to the immediate vicinity of S-TEAD. Greatest airborne exposures would be in the north-south direction coinciding with prevailing wind patterns. Waterborne exposures would be in the south-west, west, and northwest directions as off-site terrestrial vegetation may be exposed to chemical contaminants from sediments washed from S-TEAD, or that have been eroded from the soil to air by wind (RI, 1989, USATHAMA, 1988).

The air exposure pathway for plants has not been evaluated because appropriate toxicity data are not available for the chemicals of potential concern in the soils at the CAMDS facility area. However, the geometric mean and maximum concentrations of the chemicals of potential concern in the surface soils of the Deactivation Furnace mercury spill area (Table 4-16) were used to assess potential chemical-related phytotoxic effects from surface soil exposures to on-site vegetation. (see Section 4.2.3).

Off-site wildlife may be exposed to chemicals of potential concern in surface soils, surface water, and sediment by several pathways: 1) ingestion of soil or sediment while foraging or grooming; 2) ingestion of food that has accumulated chemicals from soil, surface water or sediment; 3) ingestion of surface water; 4) dermal absorption; and 5) inhalation of chemicals that have volatilized or been wind-eroded from soil. However, qualification of receptor-specific exposures via these pathways is limited by the lack of appropriate exposure assessment data (RI, 1989, USATHAMA, 1988).

#### On-Site Exposure Impacts to Humans

The only human populations that frequent the S-TEAD site are workers at the facility, consisting of the CAMDS staff, guards, and workers in the warehouse and chemical ammunition storage areas. Because the facility is fenced and access is controlled, no other individuals (e.g., trespassers) come onto the site. Possible on-site worker exposure pathways are discussed below for current land use conditions for CAMDS (RI, 1989).

Exposure of CAMDS workers or other S-TEAD personnel to chemicals of potential concern in surface water, sediment, subsurface soil and groundwater by ingestion or direct contact is unlikely because there is no use of these media in the boiler blowdown area or the old sewage lagoon (RI, 1989).

Theoretically, workers could be exposed via inhalation to chemicals in surface water or sediment that volatilize or to chemicals in the dry sediments of the blowdown area drainage ditch that are carried to the air by wind. Exposures to the volatile chemicals cannot be quantified because the volatile chemicals

Table 4-16

Chemicals of Potential Concern in  
Soils of the Deactivation Furnace Mercury  
Contamination Area of S-TEAD  
(Concentration reported as ug/g)

Chemical	Frequency of Detection	Geometric Mean Concentration	Maximum Detected Concentration
<u>Surface Soils<sup>a</sup></u>			
<u>Mercury Spill Area<sup>b</sup></u>			
Mercury	7/8	41.5	7,180
Nitrobenzene	1/8	0.25	0.86
<u>Fuel Spill Area<sup>c</sup></u>			
Nitrobenzene	1/1	NA	0.86
Petroleum hydrocarbons	1/1	NA	28,000
<u>Surface Soils<sup>d</sup></u>			
<u>Mercury Spill Area<sup>e</sup></u>			
Mercury	14/14	10.3	350
<u>Fuel Spill Area<sup>f</sup></u>			
Petroleum Hydrocarbons	3/3	1.210	2,300

<sup>a</sup>Surface soils are defined as 0-0.5 feet for the mercury spill area and 0-1 feet for the fuel spill area.

<sup>b</sup>Samples SSMS-01, 04, 07, 10, 13, 16, 19, and 22..

<sup>c</sup>Sample SSDT - 01-01.

<sup>d</sup>Subsurface soils are defined as 0.54-2.5 feet for the mercury spill area and 1-5 feet for the fuel spill area.

<sup>e</sup>Samples SSMS-02, 03, 05, 06, 08, 11, 12, 14, 15, 17, 18, 20, and 21.

<sup>f</sup>Samples SSDT-01-01, 01-03, and 01-04.

NA = Not Applicable; single sample

Source: RI, 1989

present in the CAMDS area surface water and sediment samples are "unknown" (i.e., they have not been identified analytically). Nevertheless, inhalation exposures from volatilization are not likely to be significant because the concentrations of unknown volatile chemicals are low (ppb range) so that dispersion likely would result in negligible air concentrations (RI, 1989).

Inhalation exposures as a result of wind erosion of fluoride and petroleum hydrocarbons in dry ditch sediments also are likely to be low because: 1) dry ditch sediments are likely to be cemented and less likely to be eroded by wind; 2) the ditch is depressed and therefore provides less area for unobstructed wind flow; and 3) the ditch is small relative to the size of the total CAMDS area. Therefore, even though the concentrations of petroleum hydrocarbons are high in the ditch, potential air exposures are likely to be negligible. Potential exposure of CAMDS personnel is reduced further because they generally work inside the facility's buildings (closed windows and filtered ventilation would reduce exposure concentrations) (RI, 1989).

#### On-Site Exposure Impacts to the Environment

Based on information analyzed in the Endangerment Assessment (RI, 1989) the following are assessed for potential impacts to on-site vegetation, wildlife, and aquatic life:

- Soil contamination at the site may be impacting vegetation. The sparse or absent vegetation in some of the study areas may in fact be due to elevated concentrations of inorganic chemicals, for example, the sulfate and nitrate spills at the CAMDS area. It is difficult to more thoroughly evaluate vegetation impacts at S-TEAD because the extent of surface soil contamination is not completely known. If surficial soil contamination and, consequently, potential vegetation impacts are limited to the study areas and areas immediately adjacent, the overall impact on the plant community and habitat quality at S-TEAD is likely to be minimal.
- Sage grouse, blacktailed jackrabbit, and mule deer do not appear to be at increased risk of adverse impacts from drinking surface water at S-TEAD. Estimated daily chemical intakes are below the toxicity values derived for these species.
- Aquatic life in the surface waters at the site does not appear to be at increased risk from exposure to the chemicals of potential concern. Geometric mean concentrations of these chemicals are below their respective aquatic toxicity values or criterion.

#### 4.1.4.3 Investigation and/or Remedial Activities at CAMDS

The fuel spill which occurred at the CAMDS facility in January 1978 was cleaned up in accordance with TEAD's Spill Prevention Control and Counter Measure Plan and the Installation Spill Contingency Plan. Other reported spills listed on Table 4-7 do not indicate remedial actions. During the RI additional groundwater monitoring wells were installed around the CAMDS facility to characterize groundwater quality and flow. A total of nine monitoring wells exist in the CAMDS facility area.

#### 4.1.4.4 Data Needs and Recommendations

##### Groundwater

Monitoring of groundwater wells should continue both on and around the CAMDS facility area to follow the migration of arsenic, petroleum hydrocarbons, SOCs, explosives, chemical agent breakdown products, and radiochemical parameters (using an analytical technique such as coprecipitation, which is appropriate for radiochemical samples high in TDS). Additional monitor wells west and northwest of the CAMDS facility area would aid in determining whether groundwater flows from CAMDS toward the base perimeter or whether it turns northwest, as suggested (though not proven) by the current potentiometric maps. It is further recommended that a year-long quarterly water level monitoring program be initiated to document seasonal variations in the existing and future monitoring wells between the CAMDS facility area and the western/southwestern perimeter.

An aquifer pumping test run for 48 hours near the CAMDS area is recommended. This is the most reliable method for estimating aquifer hydraulic conductivity (K). Based on observations of water levels near the pumping well, an integrated K value over a sizable aquifer section could then be obtained. This information would be needed in evaluating groundwater extraction as a viable option for remediation of the CAMDS facility area groundwater, if required (RI, 1989).

The critical issue appears to be one of risk management, considering the apparent lack of realistic downgradient receptors and the overall contamination situation at S-TEAD.

##### Surface Soils, Surface Water and Sediment

Further sampling and analysis of the boiler blowdown prior to discharge and of the soils around the discharge point is needed to isolate the source of the nitroaromatic compound detected at the discharge point in the surface water. The boiler blowdown discharge is also a potential source of unknown volatile and semivolatile organic compounds. The horizontal and vertical extent of contamination should be further investigated by additional sampling and analysis of soils in this area. In addition, the horizontal and vertical extent of contamination of petroleum hydrocarbons in and around the boiler blowdown discharge area should be further investigated via soil sampling and analysis (RI, 1989).

Further sampling of the drainage channels downgradient of the CAMDS facility area is needed to determine the extent of petroleum hydrocarbon contamination (a field screening and analytical verification approach is recommended). Analysis of the ponded water on the western perimeter for petroleum hydrocarbons should be performed to evaluate whether these hydrocarbons have migrated toward the ponded water (RI, 1989).

The boiler blowdown hardware within the plant should be investigated to determine if there is an operational or design change that can be made to reduce or eliminate this potential source.

All areas of concern identified that are part of the CAMDS SWMU should also be investigated to determine if any releases have occurred from these units. A determination should be made which sites within the fenced area of CAMDS have not been investigated. It is recommended that the additional areas within CAMDS lacking information on releases be investigated during the RFI Phase II Study.

#### 4.2 Deactivation Furnace Mercury Contamination Area

##### 4.2.1 Unit Description

The S-TEAD Deactivation Furnace (Figure 4-7) is located in the north-central portion of S-TEAD between Gardener Road and Blume Street. The purpose of the deactivation furnace was to serve as a prototype of the CAMDS facility by disposing of fuses, first-fire mixes, primers, and small arms. From 1976 to 1982 experimental disposal tests were conducted on CS-filled M25 riot grenades, M674 projectile (40mm) and the M158 Tactical Cannister which have also contained explosives B and RDX and agent simulant (ethylene glycol). CS is a white crystalline solid that is only slightly soluble in water. Hydrolysis products are o-chloro-benzaldehyde and malonitule. Ethylene glycol is a colorless hygroscopic liquid (RI, 1989). The tests were not successful and the operations were aborted. The residual ash material was decontaminated and removed from the site (USATHAMA, 1979).

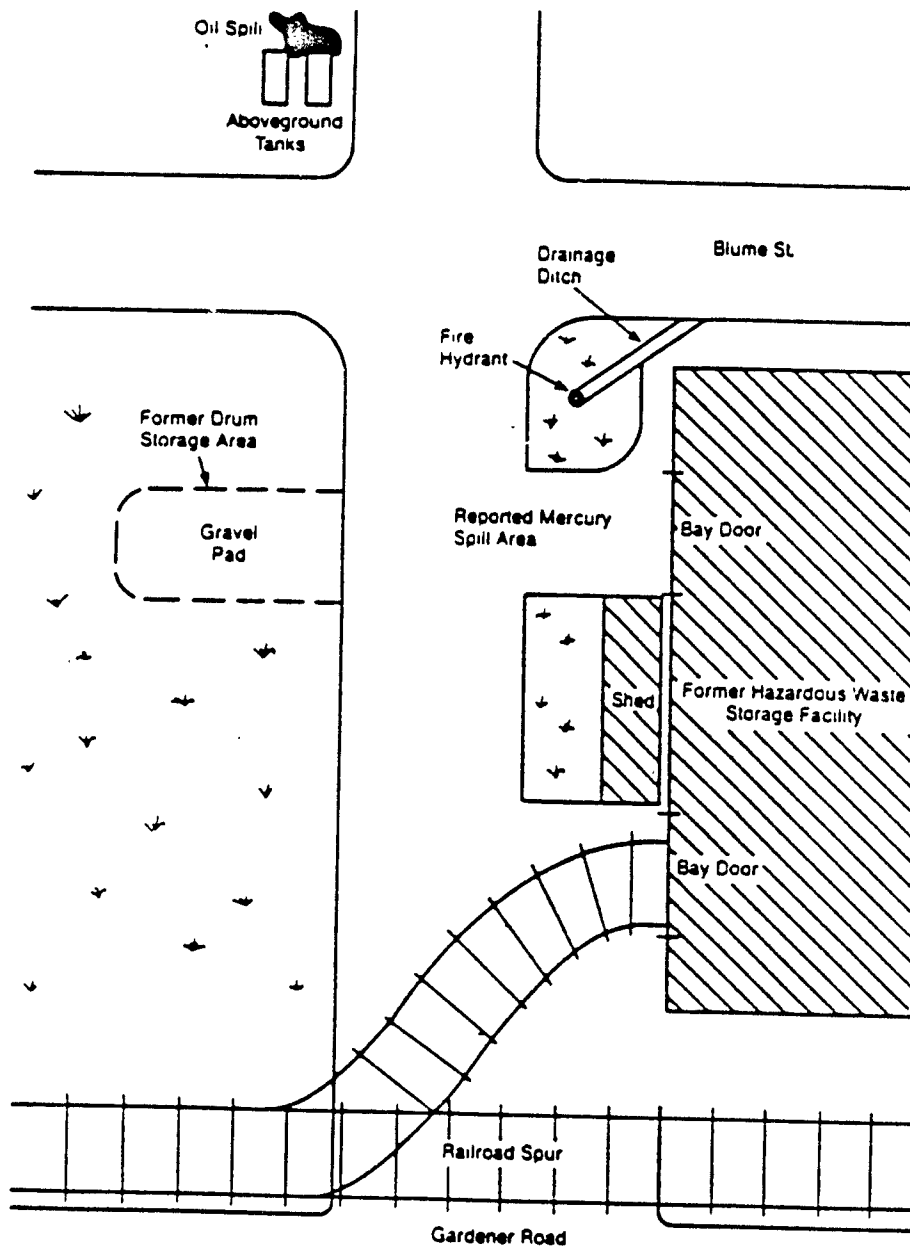
The Deactivation Furnace was dismantled, the equipment was removed from the building and placed on the ground approximately 400 feet northeast of the building (RI, 1989).

##### 4.2.2 Waste and Product Spill Areas

Following dismantling of the furnace, the building was used to store drums of various hazardous chemicals used at S-TEAD (including mercury). In 1986, according to the CAMDS plant manager, approximately 56 drums containing mercury, which originated from the sulfur dioxide and nitrogen oxides air monitors, were tipped over and the mercury was released to the soil. During the site visit, an area east of the building was roped off and covered with plastic tarp. Reportedly, this is the area where the mercury spill occurred. However, the USATHAMA project officer indicated that the spill may have occurred closer, perhaps adjacent, to the building.

Currently, the building is used to store empty drums which have been contaminated with hazardous wastes. The existing structure is in poor condition and partially collapsed.

On the northeast side of the building, an aboveground tank that rests on a rack was observed to be slowly leaking oil in 1988. At that time, the oil spill had resulted in a surface stained area of less than 20 square feet (RI, 1989). During the site visit, the tank was still in the vicinity, however there was no visual evidence of oil.



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SOURCE: WESTON, VOL. I, 1989

0 50 100  
SCALE: FEET

# Donohue DEACTIVATION FURNACE AREA DETAIL

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FIGURE 4-7

#### 4.2.3 Nature and Extent of Contamination

##### 4.2.3.1 Data on Location and Extent of Contamination

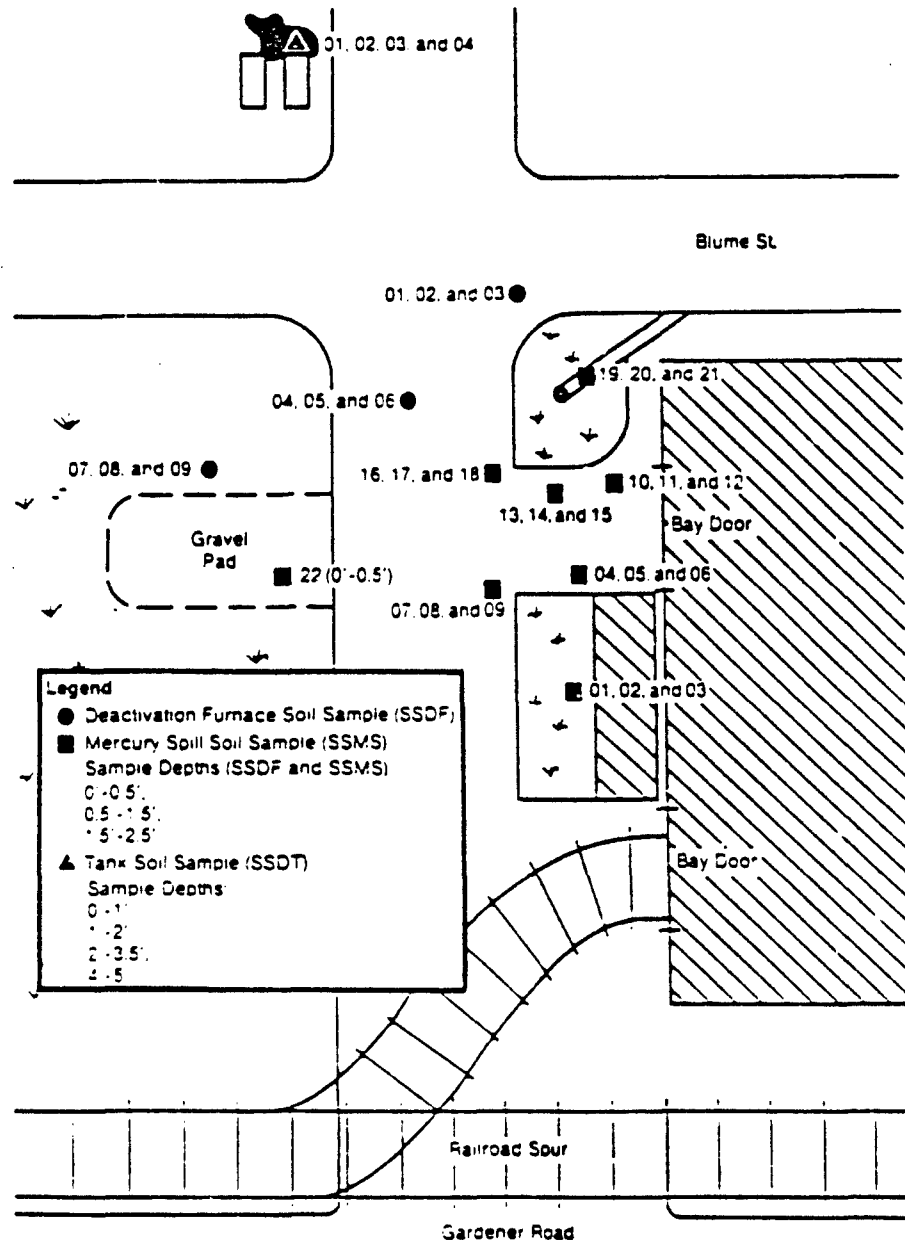
As described in Section 4.2.1, documented releases at the Deactivation Furnace site include mercury and diesel fuel spills. During the RI, reddish-brown stained areas were observed between the inactive Deactivation Furnace and the storage building. In addition, because the Deactivation Furnace was active for a short period of time and handled small munitions, there is a possibility that the soil is contaminated with explosives (RI, 1989). Areas of soil sampling during the RI are shown in Figure 4-8.

##### 4.2.3.2 Mercury Spill Area

Prior to the remedial investigation, TEAD sampled and analyzed the mercury spill area and confirmed the presence of mercury. During the RI, soil samples taken from the mercury spill were analyzed for mercury and explosives. Twenty-three samples (SSMS-01 through SSMS-22) were taken at eight locations at the mercury spill area. At seven locations, three samples were taken at depths of 0 to 6 inches, 0.5 to 1.5 feet, and 1.5 to 2.5 feet, respectively. SSMS-22 was taken at depths of 0 to 6 inches, approximately 20 feet west of the road adjacent to the storage facility. One duplicate sample (SSMS-02D) was taken (RI, 1989).

The chemical analysis of soil samples from the mercury spill area, as depicted in Table 4-17, indicated elevated levels of mercury at the surface (0-5 feet) in the area of the reported spill. Mercury ranged from below detection limits in three background samples to 4.6 ppb in a background sample collected on the eastern perimeter of the site. The highest concentrations in the spill area occurred in surface soils at locations along the gravel access road leading to a set of bay doors of the former hazardous waste storage facility where reddish-brown staining was observed. Along this access road, concentrations of mercury in the top 6 inches of soil ranged from 3.42 ug/g in SSMS-10 to an average of 7,300 ug/g in duplicate samples of SSMS-04. The highest concentrations were at SSMS-04 and SSMS-07 at 1,600 ug/g; and SSMS-13 at 4,200 ug/g; all from depths of 0 to 0.5 feet. Concentrations of mercury significantly decreased with depth; however, concentrations remained elevated at several locations at a depth of 0.5 to 1.5 feet: 350 ug/g in SSMS-05, 54 ug/g in SSMS-08, 150 ug/g in SSMS-14, and 46.0 ug/g in SSMS-17. At depths of 1.5 to 2.5 feet, mercury concentrations decreased to 37 ug/g in SSMS-06; 5.10 ug/g in SSMS-09; 1.81 ug/g in SSMS-12; 7.10 ug/g in SSMS-15; and 9.6 ug/g in SSMS-18. Samples below this depth were not taken and therefore the vertical extent of mercury contamination is unknown (RI, 1989).

Mercury was also present in a low depression area located adjacent to the driveway (3.1 ug/g at 0 to 0.5 feet; 2.6 ug/g at 0.5 to 1.5 feet; and 2.0 ug/g at 1.5 to 2.5 feet), but within the background ranges. Mercury was also detected within the background range in a drainage ditch that receives runoff from most of the reported spill areas at concentrations of 1.96 ug/g at 0 to 0.5 feet; 1.36 ug/g at 0.5 to 1.5 feet; and 2.16 ug/g at 1.5 to 2.5 feet. Mercury was not detected above reporting levels in a sample taken west of the spill area in the former drum storage area (RI, 1989).



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SOURCE: WESTON, VOL. 1, 1989

0 50 100  
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OCTOBER, 1989

# **DEACTIVATION FURNACE AREA SOIL SAMPLING LOCATIONS**

**SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH**



**FIGURE 4-8**

Table 4-17

Analyses of Surface Soil Samples from the Deactivation  
Furnace Mercury Spill Area

Sample No.	Depth (ft)	Parameter	
		Mercury Concentrations in ug/g	Explosives
SSMS-01	0-0.5	3.1	LT
SSMS-02	0.5-1.5	2.6	LT
SSMS-02D	0.5-1.5	3.4	LT
SSMS-03	1.5-2.5	2.0	LT
SSMS-04	0-0.5	6,000	LT
SSMS-04D	0-0.5	8,600	LT
SSMS-05	0.5-1.5	350	LT
SSMS-06	1.5-2.5	37	LT
SSMS-07	0-0.5	1,600	LT
SSMS-08	0.5-1.5	54	LT
SSMS-09	1.5-2.5	5.1	LT
SSMS-10	0-0.5	3.42	LT
SSMS-11	0.5-1.5	2.26	LT
SSMS-12	1.5-2.5	1.81	LT
SSMS-13	0-0.5	4,200	LT
SSMS-14	0.5-1.5	150	LT
SSMS-15	1.5-2.5	7.1	LT
SSMS-16	0-0.05	180	LT
SSMS-17	0.5-1.5	46	LT
SSMS-18	1.5-2.5	9.6	LT
SSMS-19	0-0.5	1.9	LT
SSMS-20	0.5-1.5	1.36	LT
SSMS-21	1.5-2.5	2.76	LT
SSMS-22	0-0.5	LT	LT
Rinse Blank (RBMS-01)		0.17 ug/L	LT

D - Duplicate sample

Source: RI, 1989

Explosives above detection levels were not detected in any of the samples collected in the spill area (RI, 1989).

Mercury compounds present in the air were monitored during sampling. Concentrations as high as  $0.26 \text{ mg/m}^3$  were recorded close to the ground surface (Occupational Safety and Health Administration ceiling -  $0.1 \text{ mg/m}^3$ ).

In summary, the results of the analysis of the mercury spill area indicated elevated concentrations of mercury at the surface (0 to 1.5 feet) along the access road that leads to a bay area in front of the former hazardous waste storage area. The horizontal extent of the mercury spills is limited to the gravel access road leading to the bay doors of the storage building. Concentrations decreased significantly with depth. Although concentrations above background were detected at 1.5 to 2.5 feet below the surface, they were one order of magnitude lower than in the surface soils (0 to 0.5 foot depth). Figures 4-9 through 4-11 present concentration isopleths for depths of 0 to 0.5 feet, 0.5 to 1.5 feet, and 1.5 to 2.5 feet. However, mercury was detected at concentrations ranging from 1.81 to 37 ppm at a depth of 1.5 to 2.5 feet (RI, 1989).

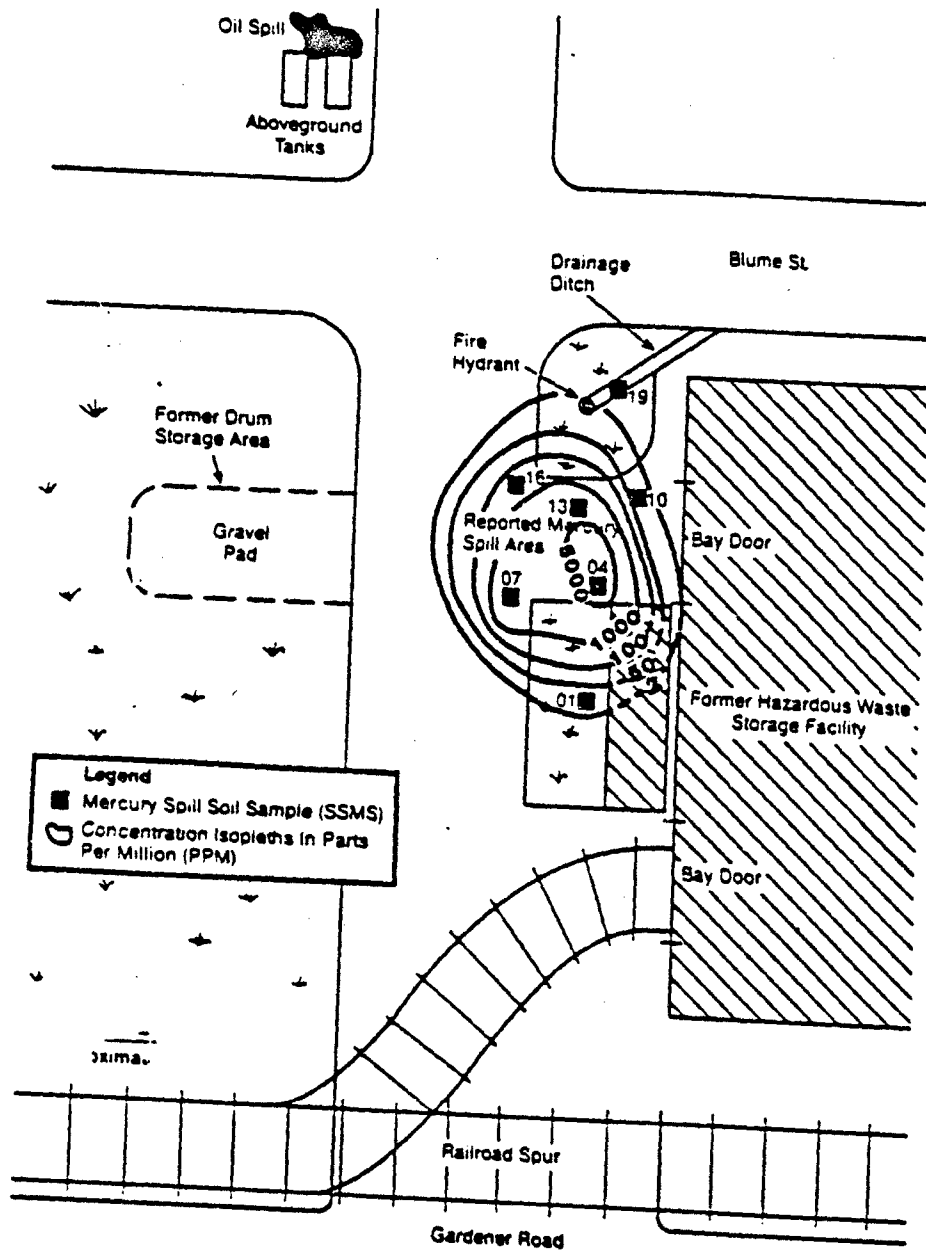
#### 4.2.3.3 Fuel Oil Spill Area

Although the leaking aboveground tank had been discovered prior to the RI, no sampling was performed until the RI. Four soil samples (SSDT-01-01 through SSDT-01-04) were taken at intervals of 0 to 1 feet, 1 to 2 feet, 2 to 3.5 feet and 4 to 5 feet, respectively.

The results of the chemical analysis of soil samples from the oil spill are presented in Table 4-18. The chemical analysis of soil samples from the oil spill area indicated petroleum hydrocarbon concentrations of 28,000 ug/g, 1,600 ug/g, 2,300 ug/g, and 480 ug/g at depths of 0 to 1 feet, 1 to 2 feet, 2 to 3 feet, and 4 to 5 feet, respectively. Explosives analyses of these soil samples indicated the presence of nitrobenzene at a concentration of 0.86 ug/g in sample SSDT-01-01, taken from 0 to 1 feet. Results of the explosives, VOCs, BNAs/pesticides, and PCBs analyses indicated that none of these compounds were detected at concentrations above the analytical reporting levels. Based on these results and field observation of stained surface soils, petroleum hydrocarbon contamination is estimated to be limited to an area of 48 square feet (6 feet to 8 feet). The vertical extent of the petroleum hydrocarbon contamination is unknown since contamination was still detected at the limit of sampling (5 feet). The source and horizontal extent of the nitroaromatic compound (nitrobenzene) contamination is not known based on the RI sampling and analysis. The vertical extent of the contamination appears to be limited to the upper 1-foot of soil in the area of sampling (RI, 1989).

#### 4.2.3.4 Stained Soil Area

Ten samples were taken at stained soil areas (SSDF-01 through SSDF-09) at depths of 0 to 6 inches, 6 inches to 1.5 feet, and 1.5 to 2.5 feet. One duplicate sample, SSDF-04D, was taken on Blume Street.



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SOURCE: WESTON, VOL. I, 1989

0 50 100  
SCALE: FEET

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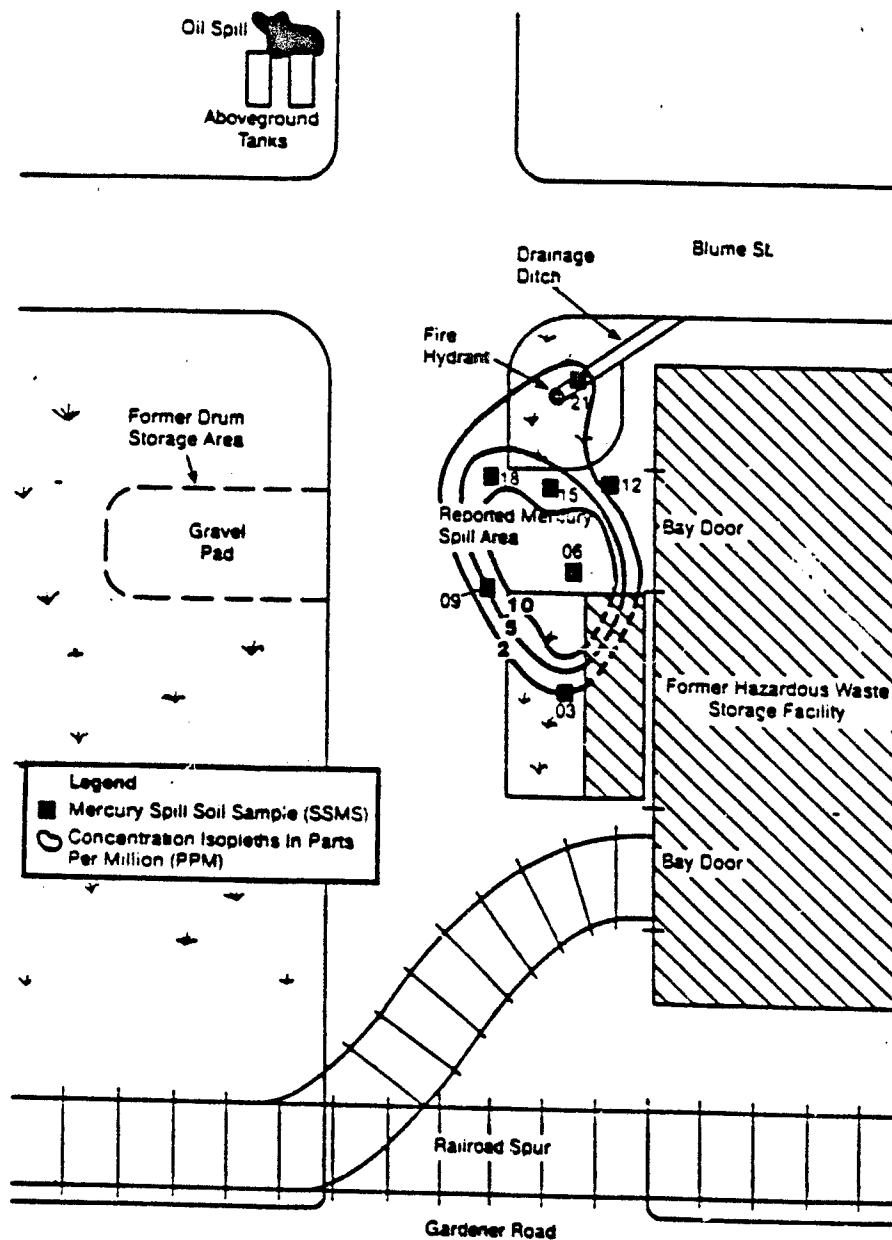
CONCENTRATION ISOPLETHS OF MERCURY IN SOIL SAMPLES  
COLLECTED FROM 0.0-0.5 FT IN THE VICINITY OF THE  
DEACTIVATION FURNACE MERCURY SPILL AREA

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FIGURE 4-9





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CONCENTRATION ISOPLETHS OF MERCURY IN SOIL SAMPLES  
COLLECTED FROM 1.5-2.5 FT IN THE VICINITY OF THE  
DEACTIVATION FURNACE MERCURY SPILL AREA

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FIGURE 4-11

Table 4-18

Analyses of Surface Soils from the Deactivation  
Furnace Oil Spill Area

Sample No.	Depth (ft)	Petroleum Hydrocarbons	<u>Explosives</u>
		Concentrations in ug/g	Nitrobenzene
SSDT-01-01	0-1	28,000	0.86
SSDT-01-02	1-2	1,600	LT
SSDT-01-03	2-3.5	2,300	LT
SSDT-01-04	4-5	480	LT
SSDT-01-05		NA	NA
Trip Blank			

LT - Below CRL

NA - Not analyzed for - trip blank analyzed only for VOA

A summary of the compounds detected, above analytical reporting levels, for the samples taken from the stained areas on the road is provided in Table 4-19. The chemical analyses of soil samples from the stained areas on the road indicated trace levels of unknown semivolatile compounds in all of the soil samples collected. Total concentrations of unknown semivolatiles of 3.22 ug/g, 4.89 ug/g, and 25.0 ug/g were detected in samples SSDF-01, taken from 0 to 0.5 feet; SSDF-02, taken from 0.5 to 1.5 feet; and SSDF-03, taken from 1.5 to 2.5 feet respectively. At the second sample location, total concentrations of unknown semivolatile compounds of 4.31 ug/g, 4.85 ug/g, 4.13 ug/g, and 20.89 ug/g were detected in samples SSDF-04 and SSDF-04D (0 to 0.5 feet), SSDF-05 (0.5 to 1.5 feet), and SSDF-06 (1.5 to 2.5 feet), respectively. None of the identified semivolatile compounds (priority pollutant list) were detected above the certified reporting level. The results indicated a small increase in the trace amounts of unknown semivolatile compounds with depth. Total concentrations of semivolatile compounds increased from 3.22 ug/g at depths of 0 to 0.5 feet, 25.0 ug/g at depths of 1.5 to 2.5 feet at the first location, and from 4.31 to 20.89 ug/g at the second sampling location. The extent of the nonpriority pollutant semivolatile contamination extended beyond the horizontal and vertical limits of sampling (RI, 1989).

Only one volatile compound was detected above reporting limits. An unknown volatile compound was detected in sample SSDF-03, taken from 1.5 to 2.5 feet, at a concentration of 3.13 ug/g. No explosive compounds were detected at concentrations above the reporting levels (RI, 1989).

The results for the three samples taken at one location at three different depths in the former drum storage area indicted the presence of semivolatile compounds. A total concentration of semivolatiles of 20.41 ug/g (9 unknown compounds), 30.16 ug/g (19 unknown compounds), and 29.83 ug/g (17 unknown compounds) at depths of 0 to 0.5 feet, 0.5 to 1.5 feet, and 1.5 to 2.5 feet, respectively, was detected. Some of the unknown SOC's in both the stained road and drum storage area samples were tentatively identified as types of hydrocarbons, typical of a fuel spill. A benzenedicarboxylic acid ester derivative was also tentatively identified in both areas. Ketones were tentatively identified in half of the samples from stained areas on the road. The horizontal and vertical extent of semivolatile contamination extends beyond the sampling area and depth. No explosive or volatile organic compounds were detected at concentrations above the reporting levels (RI, 1989).

#### 4.2.3.5 Potential Impacts to Human Health and Environment

Off-site exposure pathways to residents from the Deactivation Furnace mercury and oil spill areas are considered unlikely for the same reasons discussed under 4.1.4.2 for CAMDS: 1) surface water generally ponds on-site; 2) chemical concentrations in surface soils and water are low enough that an air dispersion would result in negligible exposure point concentrations; 3) the groundwater depth is greater than 150 ft and flow off-site does not flow towards existing communities and/or community suppliers tap a different aquifer; and 4) dispersion and dilution under long distances would reduce concentrations of chemicals of concern. A conceptual exposure model is presented in Figure 4-12 for the Deactivation Furnace Mercury Contamination area.

Table 4.19

Analyses of Surface Soil Samples from the Deactivation Furnace Stained Areas on Road/Former Drum Storage Area

Parameter	Sample No.	SSDF-040										TBDF-01		TBDF-02		RBDF-01	
		SSDF-01	SSDF-02	SSDF-03	SSDF-04	Duplicate	SSDF-05	SSDF-06	SSDF-07	SSDF-08	SSDF-09	RINSE Blank	Trip Blank	Trip Blank	Trip Blank	Trip Blank	
		Concentrations in ug/g (ppb)															
emi- olatile compounds	UNK504	---	---	---	---	0.27 <sup>a</sup>	---	---	---	---	---	---	---	---	---	---	
	UNK530	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	UNK544	---	1.59	---	---	0.25	---	---	---	---	---	---	---	---	---	---	
	UNK546	---	---	---	0.35	---	---	---	---	---	---	---	---	---	---	---	
	UNK549	---	0.20	---	---	---	---	---	---	---	---	---	---	---	---	---	
	UNK552	0.70	---	---	0.76 <sup>d</sup>	---	---	---	0.31	---	---	---	---	---	---	---	
	UNK553	2.00	---	1.36	1.55	1.23	1.42	---	---	0.69	0.72	---	---	---	---	---	
	UNK554	---	---	18.7	---	---	---	17.3	---	---	---	---	---	---	---	---	
	UNK559	---	---	---	---	---	---	---	16.3	22.1	19.5	---	---	---	---	---	
	UNK562	0.52	0.88 <sup>d</sup>	0.72	---	0.77	1.05	0.62 <sup>d</sup>	0.64	0.73 <sup>d</sup>	0.29	---	---	---	---	---	
	UNK564	---	---	0.17	---	---	0.27 <sup>c</sup>	0.17 <sup>a</sup>	---	0.39	0.29 <sup>a</sup>	---	---	---	---	---	
	UNK568	---	---	---	---	---	---	---	---	---	0.33	---	---	---	---	---	
	UNK576	---	0.15	0.17	0.21	0.18	0.25	---	---	---	0.16	---	---	---	---	12.0 ug/L	
	UNK581	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	UNK583	---	---	---	0.12	0.15	0.13	---	---	---	---	---	---	---	---	---	
	UNK593	---	0.17	0.26	0.33	0.3	---	---	---	---	---	---	---	---	---	---	
UNK594	---	0.14	---	---	---	---	---	0.18	---	---	---	---	---	---	---		
UNK595	---	---	---	---	---	---	---	---	0.25	---	---	---	---	---	---		
UNK596	---	---	0.47	---	0.48	---	0.54 <sup>a</sup>	1.22 <sup>a</sup>	1.16	0.42 <sup>a</sup>	---	---	---	---	7.0 ug/L		
UNK597	---	---	0.40	0.17	0.40	---	0.15 <sup>a</sup>	0.54	0.24	0.14	---	---	---	---	---		
UNK598	---	---	---	---	---	---	---	0.19	0.31 <sup>c</sup>	0.28	---	---	---	---	---		
UNK599	---	---	0.21	---	---	---	---	---	0.16	0.53 <sup>a</sup>	---	---	---	---	---		
UNK601	---	---	---	---	---	---	---	---	0.47 <sup>a</sup>	1.74	---	---	---	---	---		
UNK602	0.16	---	---	0.20 <sup>a</sup>	---	---	0.22	---	0.19	0.16	---	---	---	---	---		
UNK603	0.63 <sup>b</sup>	1.15 <sup>b</sup>	0.24 <sup>b</sup>	0.24 <sup>b</sup>	0.32 <sup>b</sup>	0.78 <sup>b</sup>	0.66 <sup>b</sup>	0.47 <sup>b</sup>	0.90 <sup>b</sup>	3.90 <sup>c</sup>	---	---	---	---	---		
UNK604	0.15	0.13	0.13	0.13	0.27	---	0.16	0.56 <sup>a</sup>	0.61	0.57	---	---	---	---	---		
UNK605	0.36 <sup>a</sup>	0.52	0.12 <sup>a</sup>	0.12 <sup>a</sup>	0.23 <sup>b</sup>	---	0.33 <sup>a</sup>	---	0.21	0.15	---	---	---	---	---		
UNK606	0.18	0.29 <sup>a</sup>	---	---	---	---	0.57 <sup>a</sup>	---	0.5	0.41	---	---	---	---	4.0 ug/L		
UNK607	0.14	---	---	---	---	---	---	---	0.22	0.23	---	---	---	---	---		
UNK608	0.14	---	---	0.13	---	---	---	---	0.71	---	---	---	---	---	---		
UNK609	---	---	0.13	---	---	---	---	---	0.50	---	---	---	---	---	---		
UNK610	---	---	---	---	---	---	---	---	0.16	---	---	---	---	---	---		
Volatile Compounds	UNK.09	---	---	3.13	---	---	---	---	---	---	---	---	---	---	---	---	
	UNK.09	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	

Hydrocarbon.

Bensedicarboxylic acid ester derivative.

1-Bromohydrocarbon.

Ketene-C<sub>2</sub>H<sub>4</sub>O.

Cyclic hydrocarbon.

Note: --- = Below CRL or SRL.

Source: Weaton, 1989.

R/USATHANA/MCA



Surface and subsurface soils only were sampled from four subareas within the Deactivation Furnace Mercury Contamination area. No human exposure pathways exist under current land use conditions on-site because neither the Deactivation Furnace Mercury Contamination area nor any adjacent areas are currently used by S-TEAD personnel. Surface and subsurface soils of this area could be a potential source of future groundwater contamination.

If the Deactivation Furnace were developed for some future use, however, workers could be exposed to chemicals of potential concern (mercury, nitrobenzene, petroleum hydrocarbons) by direct contact and by inhalation.

The potential exposure pathways to vegetation, wildlife and aquatic life both off-site and on-site are identical to those discussed under 4.1.4.2 - CAMDS. These include surface water and surface soils. Vegetation impacts could result from direct uptake of mercury, nitrobenzene and petroleum hydrocarbons, or from contact through spills or windblown deposition. Wildlife impacts could result from ingestion, inhalation and direct contact.

In the Deactivation Furnace Mercury Contamination area, the mean and maximum concentration of mercury (41.5 and 7,180 mg/kg) was greater than the phytotoxicity value (8 mg/kg) for vegetation. This would suggest phytotoxic responses by plants exposed to these levels. Bare areas in the mercury spill area could be related to the presence of high, lethal concentrations of mercury in some spots. Wildlife and aquatic life do not appear to be at risk from the Deactivation Furnace Mercury Contamination area (RI, 1989).

#### 4.2.3.6 Investigations and Remedial Actions

Remedial investigation field studies were undertaken during the RI to define the nature and extent of the mercury spill, sulfur dioxide and nitrogen dioxide waste spills and the diesel fuel leak around the above-ground storage tanks. These investigations added information to the understanding of contamination extent at the Deactivation Furnace Mercury Contamination area. As an interim remediation measure, the mercury spills near the deactivation furnace area has been secured and covered with heavy-duty plastic sheeting.

#### 4.2.3.7 Data Needs and Recommendations

The above surface and subsurface soil investigations resulted in specific recommendations:

- Future workers could be exposed to volatile mercury through inhalation. The contaminated soil in this area should be capped or excavated and removed to avoid future exposures.
- The petroleum hydrocarbon contaminated area around the above-ground tanks should be excavated and tested until all contaminated materials are identified and removed. The present spill area is approximately 24 square feet and reaches a depth greater than 5 feet. Further, the leaking tank should be repaired or removed.

- Further soil sampling is recommended in the area of a former drum storage site. This could be a source of SOC's.
- Monitoring wells should be installed in the area to determine whether groundwater has been impacted by mobile forms of mercury or organic compounds. Column leaching studies would be a preliminary step in determining whether the installation of monitoring wells is justified based on the mobility of the mercury compounds through the native soil (RI, 1989).

## 5.0 REFERENCES

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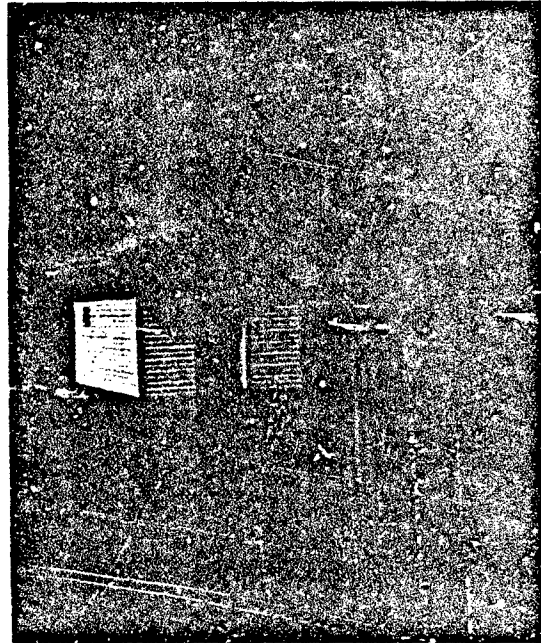
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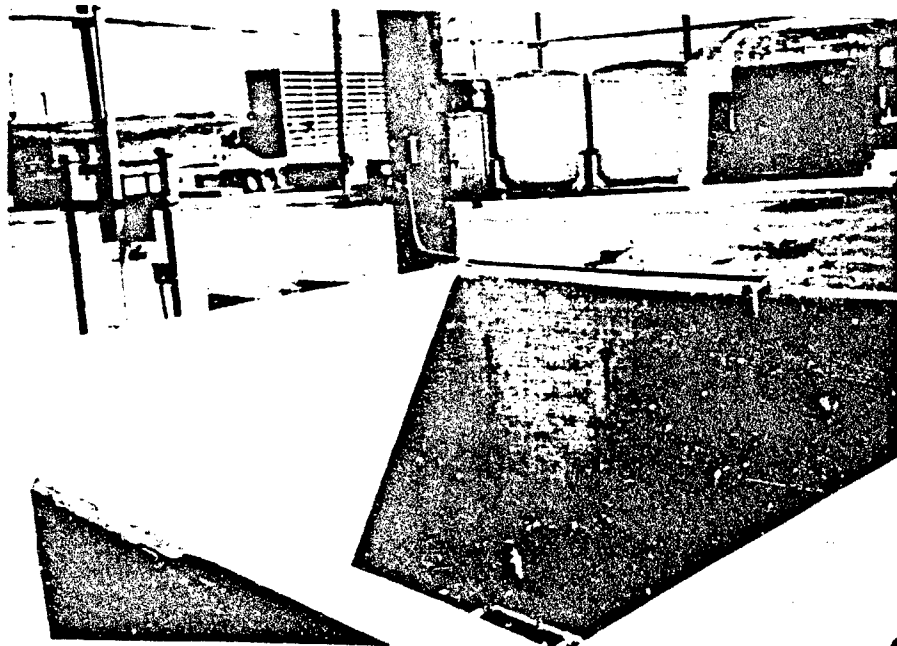
R/USATHAMA/AB7

6 0 PHOTO LOG

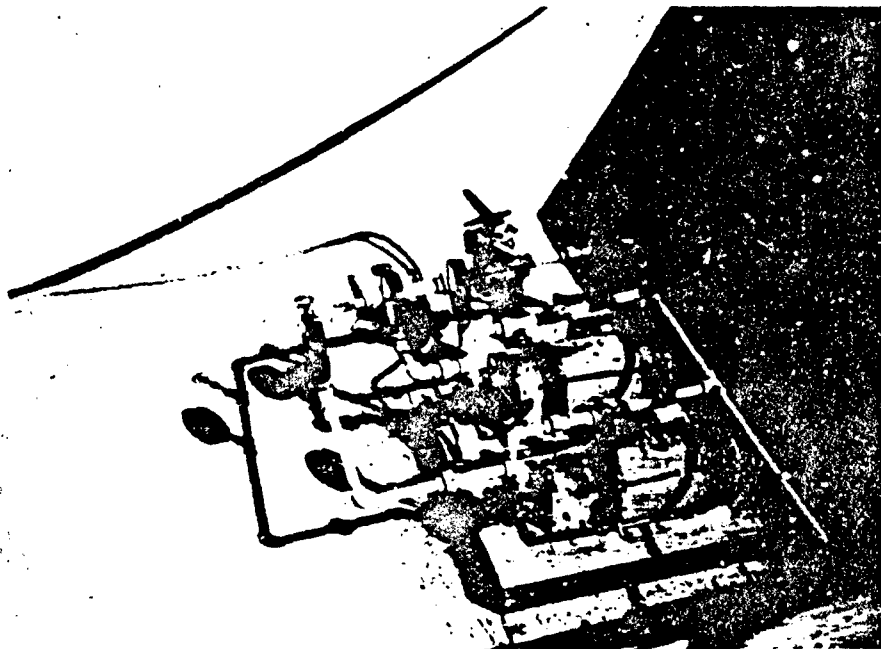
1. Location of underground storage tank for petroleum outside CAMDS (near snack shop)



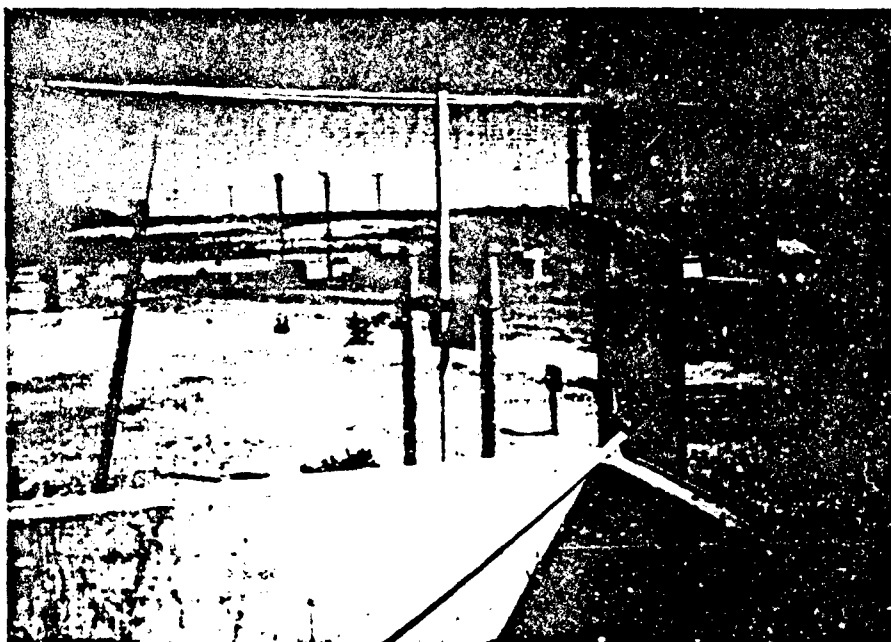
2. Pit inside CAMDS (near gate) which contains valves for diesel underground storage tank.



3. Valves/controls for diesel UST for guard shack inside CAMDS (in pit).



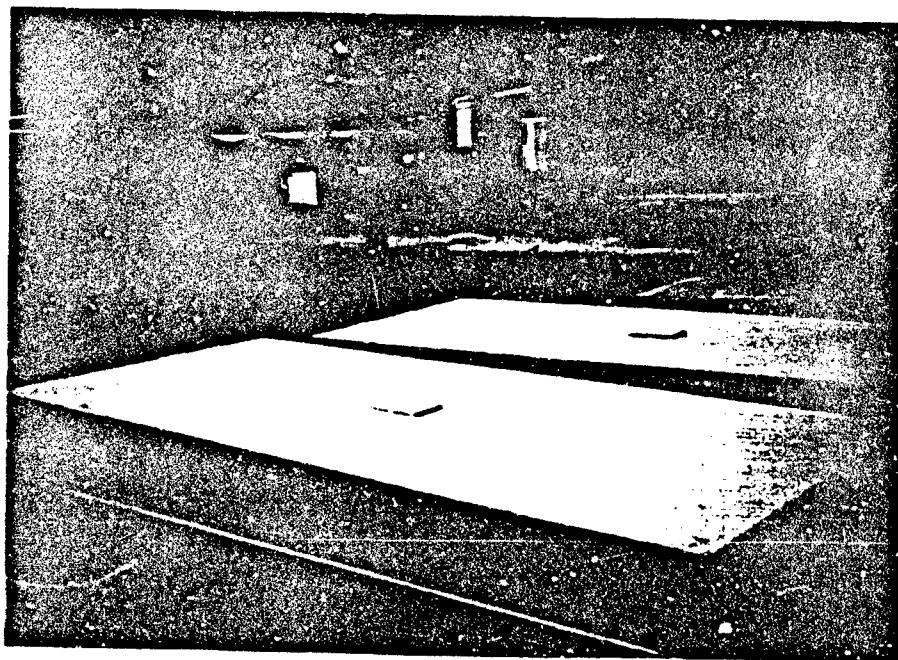
4. Edge of concrete pit in foreground, vent pipe for UST in center; drum storage area in background (90 day) inside CAMDS.



5. 90 day hazardous waste storage area -- near entrance gate to CAMDS, inside CAMDS.



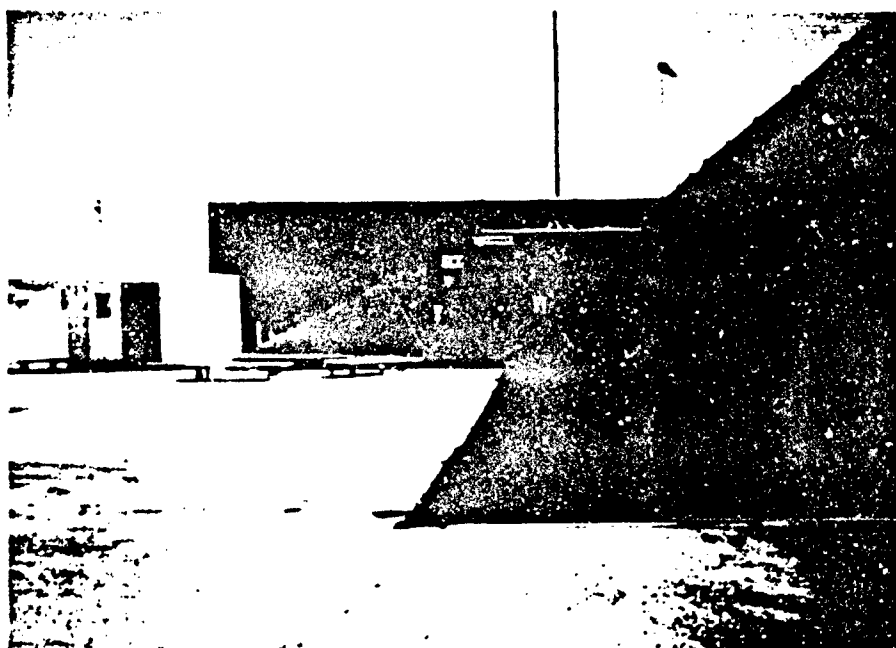
6. Empty munitions storage boxes (near drum storage area), inside CAMDS.



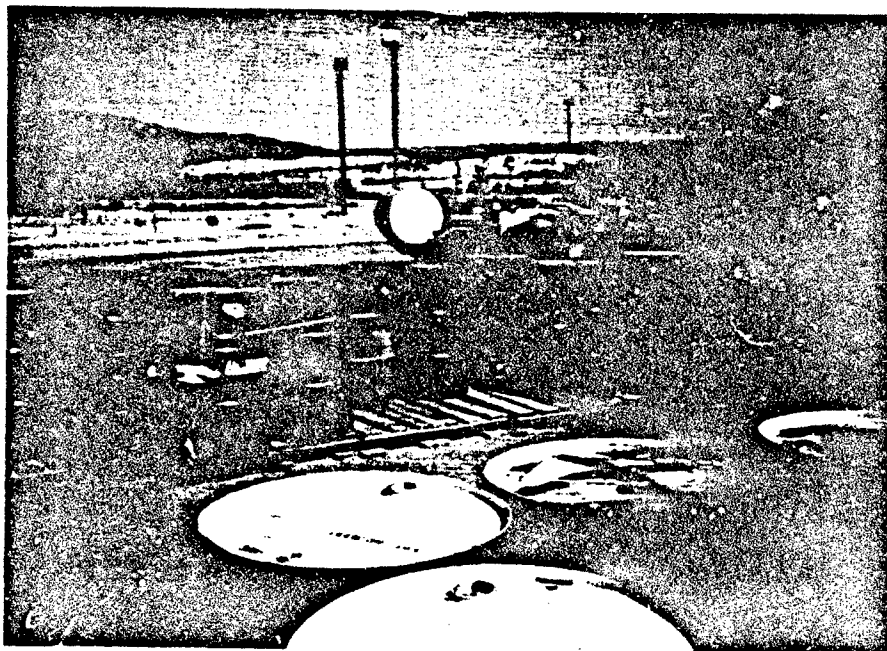
7. Empty cylinders used to store bulk chemical agent. (Munitions storage boxes in background -- also shown in photo 6), inside CAMDS.



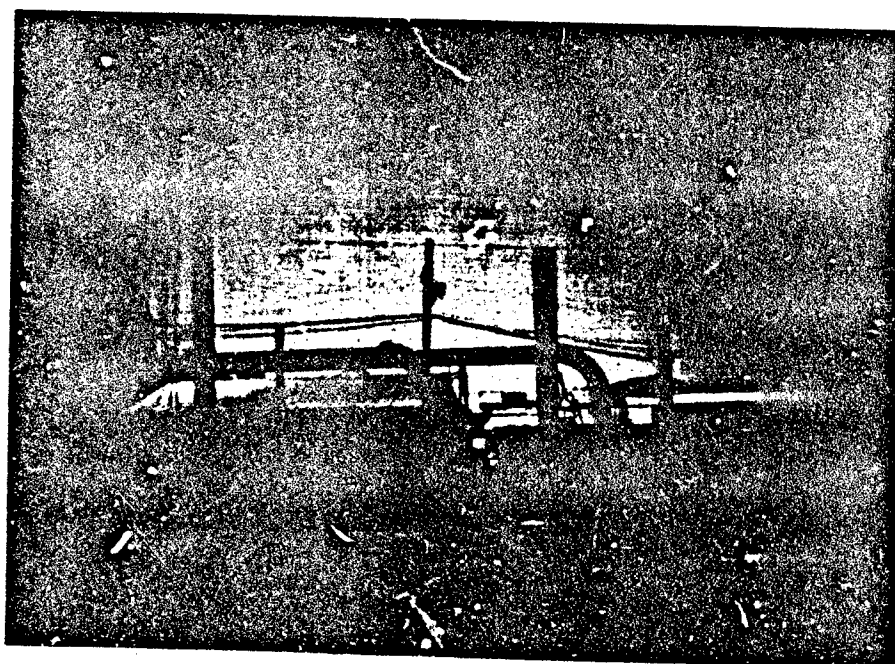
8. Hazardous waste storage area inside igloo with explosion proof wall on two sides, inside CAMDS.



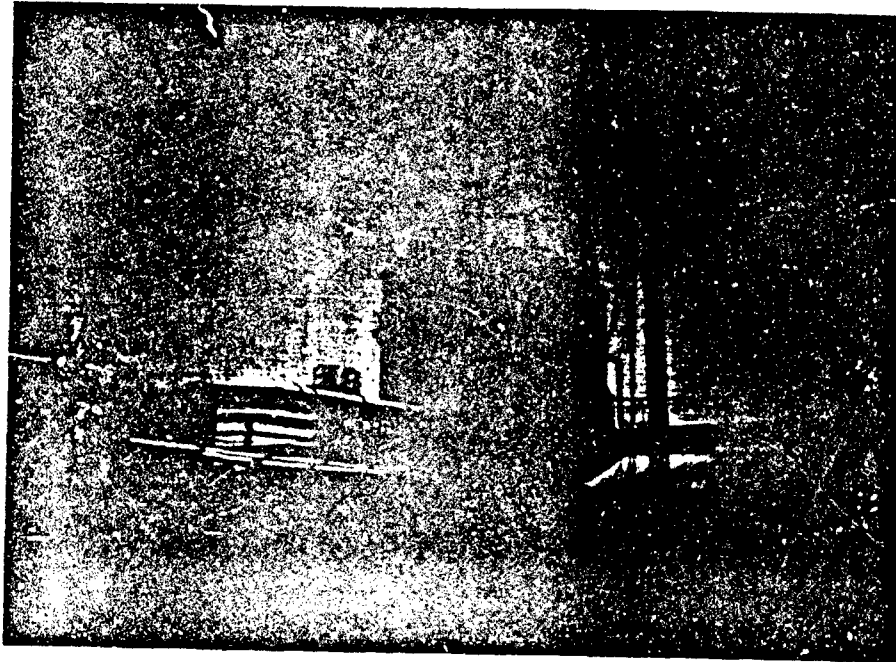
9. 90 day hazardous waste storage area; mostly waste related to LIC (Liquid Incineration), inside CAMDS.



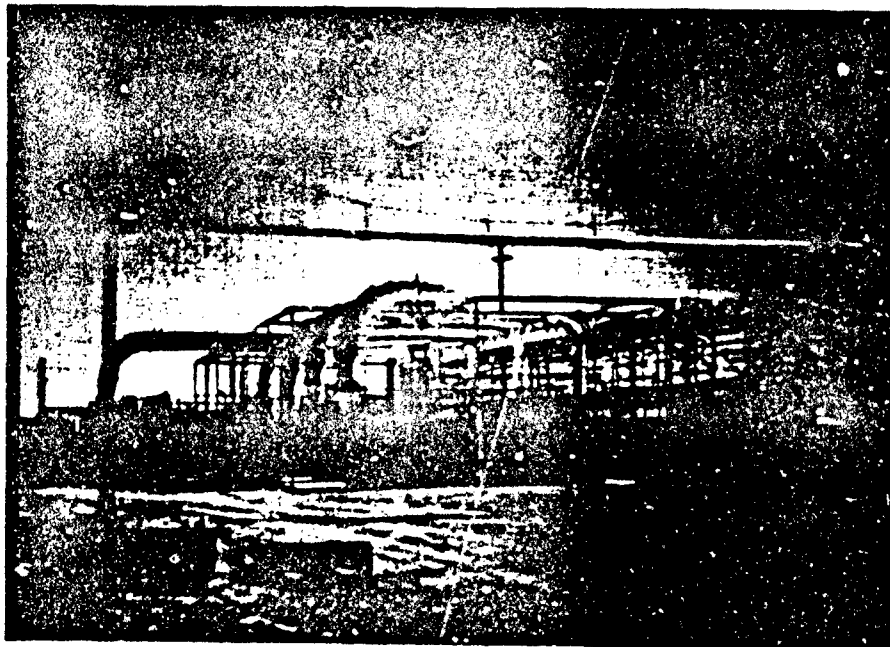
10. Toxic Dunnage Incineration (TDI) with Deactivation Furnace Mercury Contamination System (DFS) behind it, inside CAMDS.



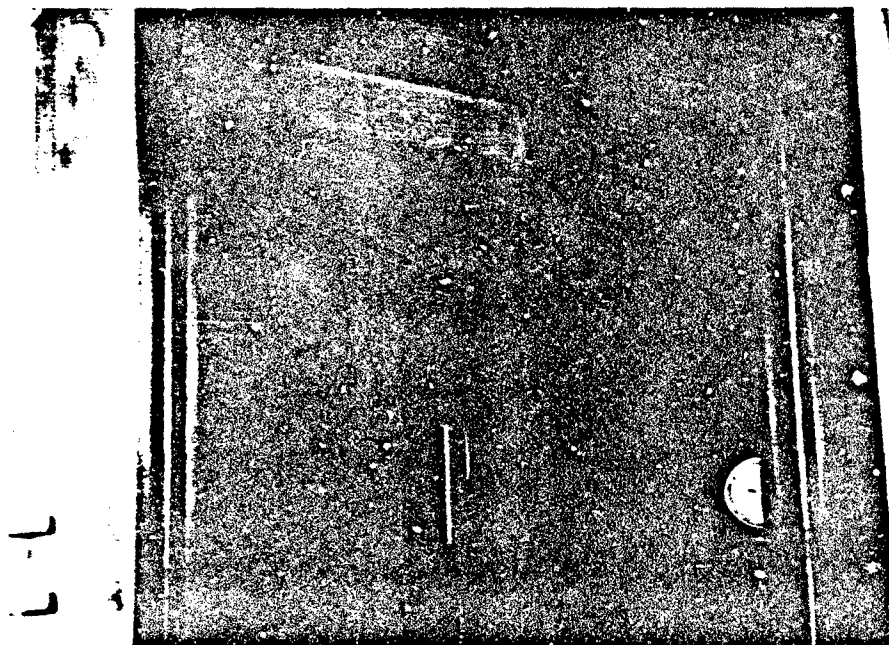
11. Pollution Control System for TDI, inside CAMDS.



12. Air purifying filters for CAMDS (white). Concrete pad under the air filters is located approximately where former 3X storage area was (a chromium and lead spill occurred here), inside CAMDS.



13. LIC toxic area (through glass window) shows tank, inside CAMDS.



14. White stain from unknown materials near floor drain in pollution abatement area (reportedly drains to a sump/tank), inside CAMDS.



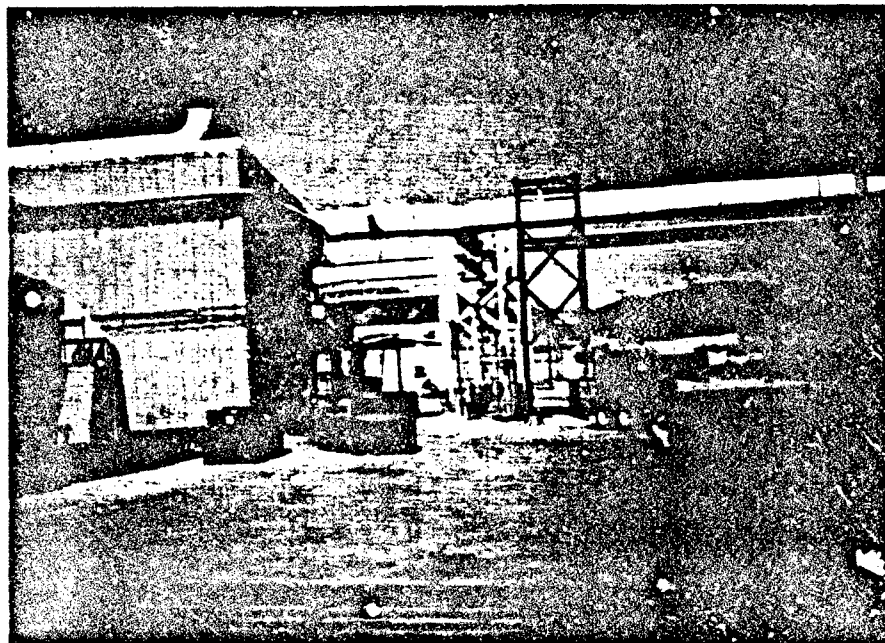
15. LIC primary chamber, inside CAMDS.



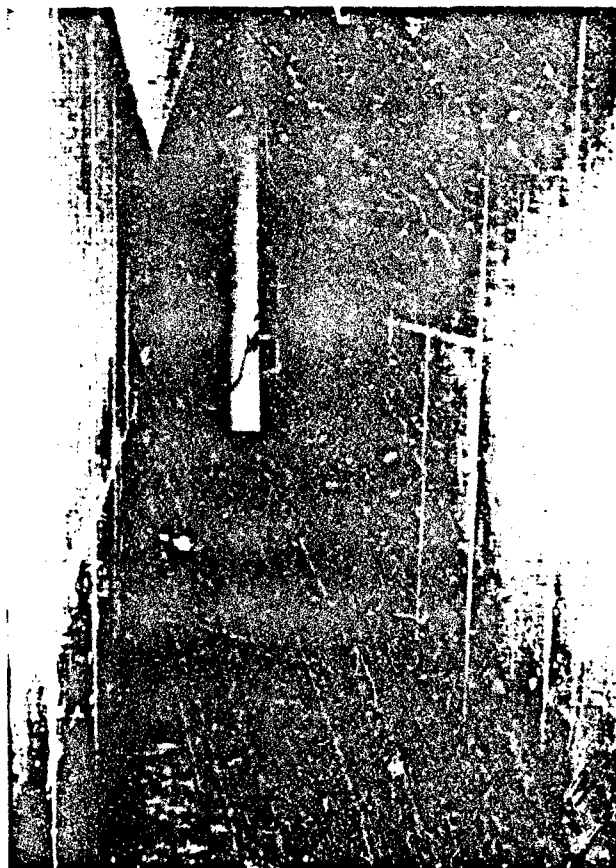
16. Ditch to west of pollution abatement area (located under concrete strip near truck). Collects stormwater from area and boiler blowdown water, inside CAMDS.



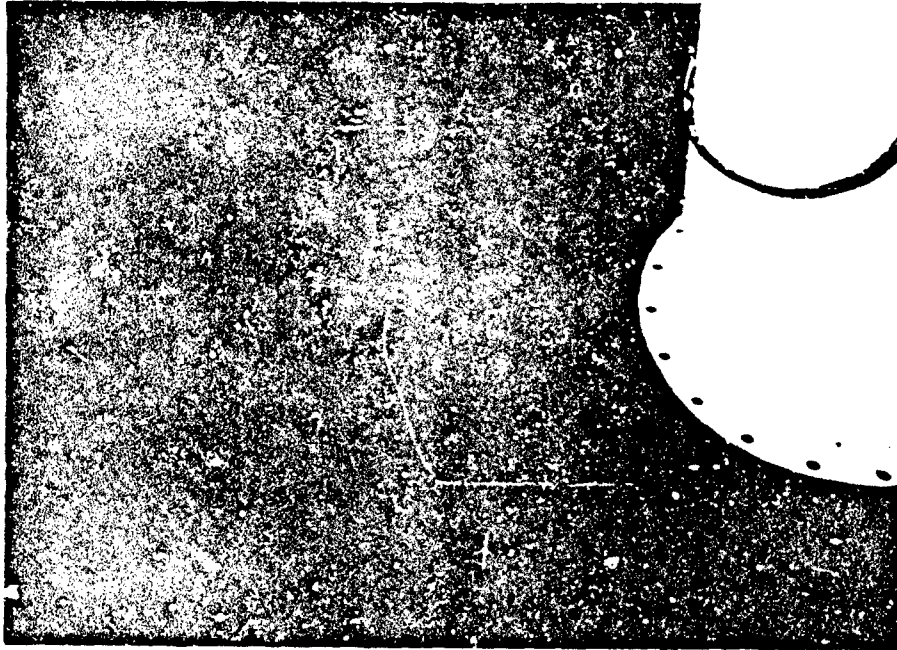
17. UST was removed from area near aboveground tank (behind forklift). UST was 1500-2000 gallons and leaked #2 diesel fuel into ground, inside CAMDS.



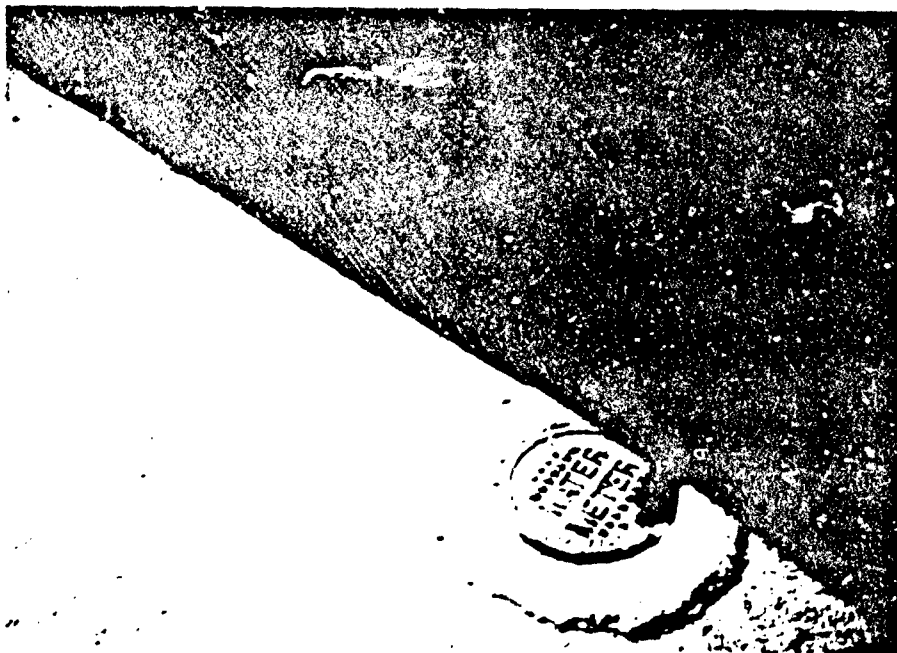
18. Inside ECC area by sump in ETF building. Diesel fuel seeps into this area during high water/heavy rains, inside CAMDS.



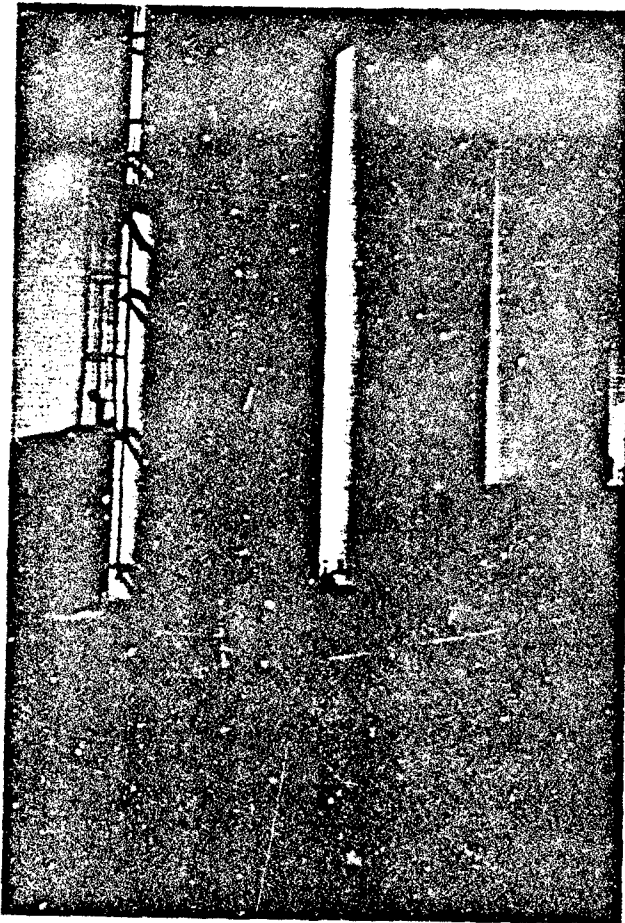
19. Inside ECC area sump/tank, inside CAMDS.



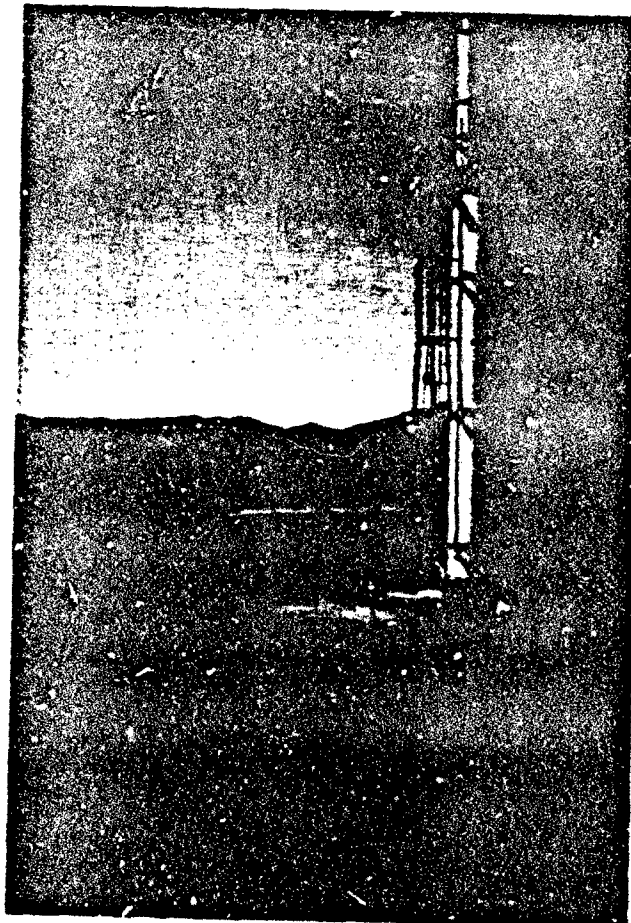
20. Cover for flush mounted groundwater monitoring well (near CAMDS tool crib), inside CAMDS.



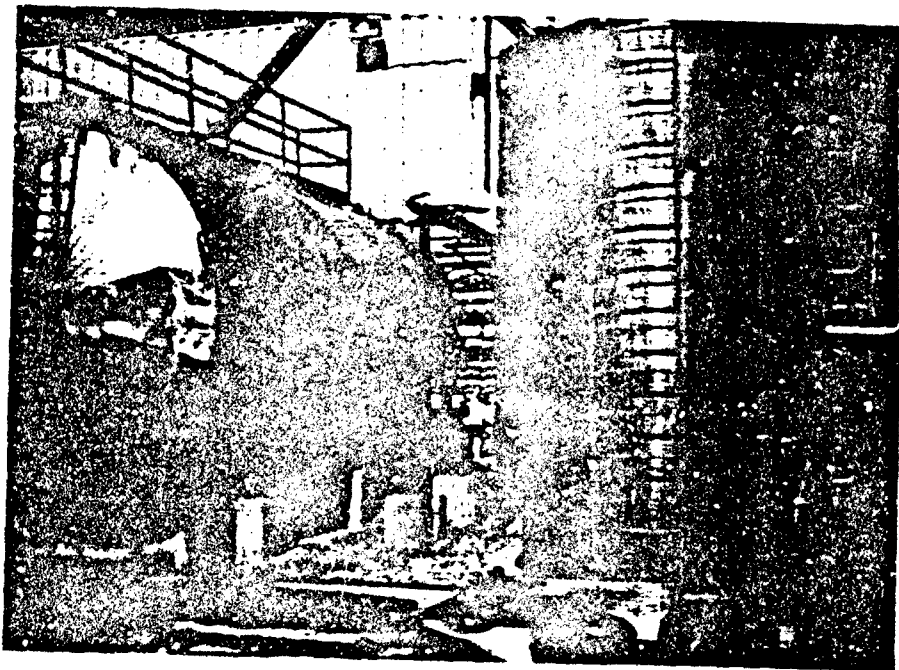
21. Three white diesel aboveground tanks where previous spills have occurred. Spills occurred before concrete pad and catch basin were built, inside CAMDS.



22. Closer view of diesel aboveground tanks and bermed area, inside CAMDS.



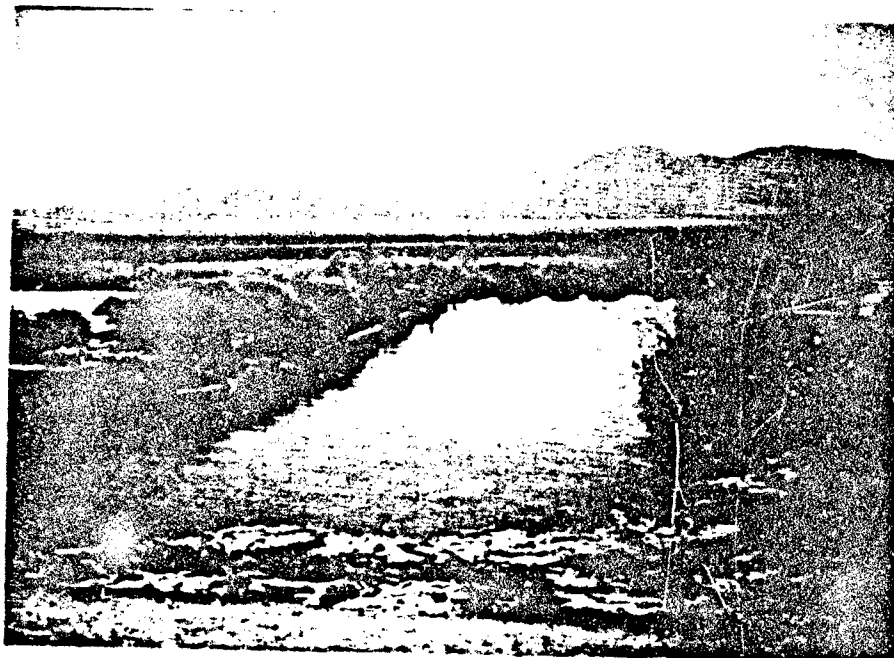
23. Silver aboveground tanks of product (sodium hydroxide and sodium hypochlorite). Pumps from these tanks have leaked. Pad is not lined (no real containment), inside CAMDS.



- 24 Brine drying area,  
inside CAMDS.



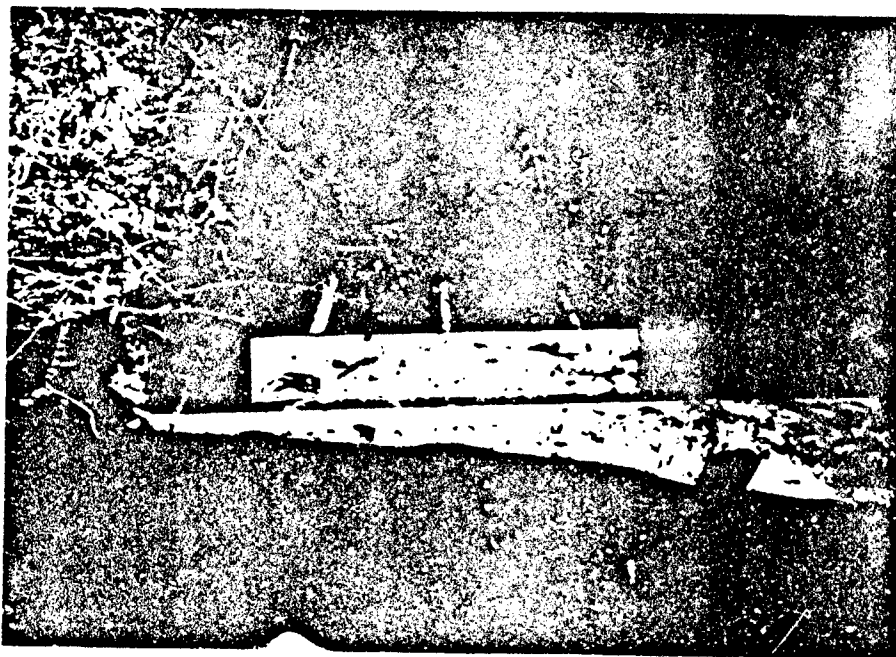
25. Raw sewage ditch west of CAMDS. Contains sanitary waste from CAMDS, outside CAMDS.



- 26 Raw sewage ditch west of CAMDS, outside CAMDS.



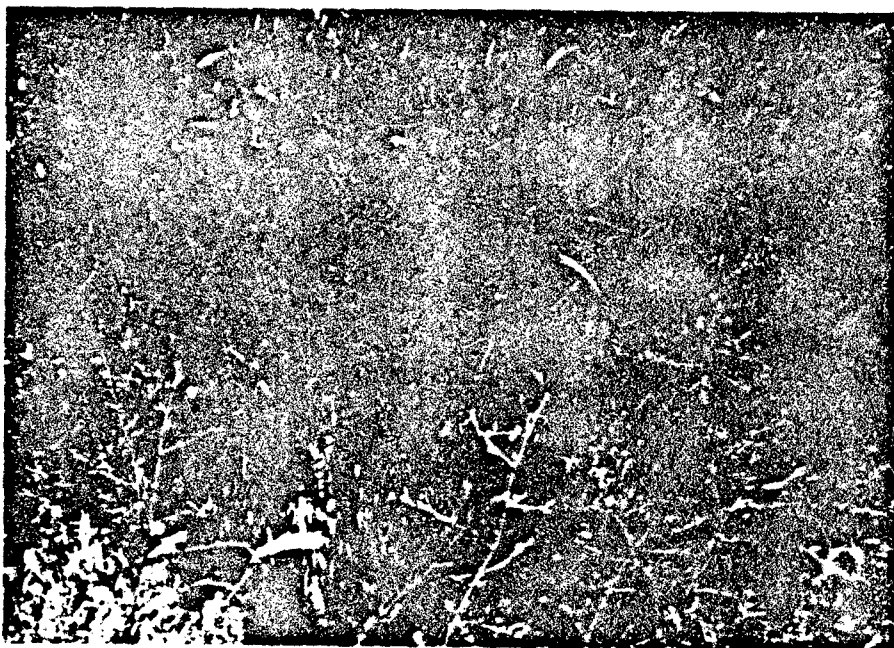
27. Drainage ditch outflow (from ditch shown in photo 17). Located due south of the white diesel aboveground tanks, outside CAMDS.



28. Pit/trench which outflow shown in photo 32 drains into, outside CAMDS.



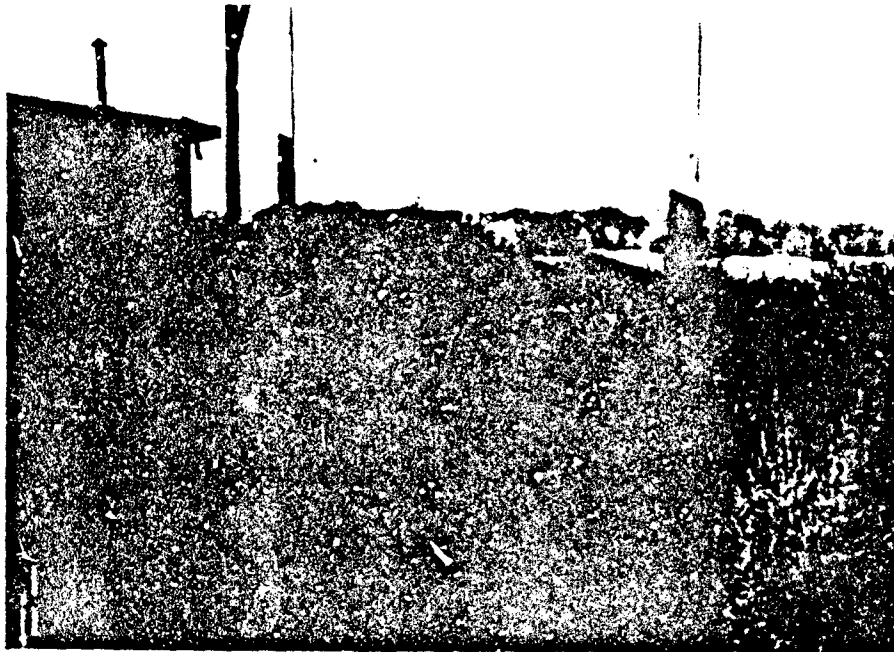
29. Pit/trench from drainage ditch outflow, outside CAMDS.



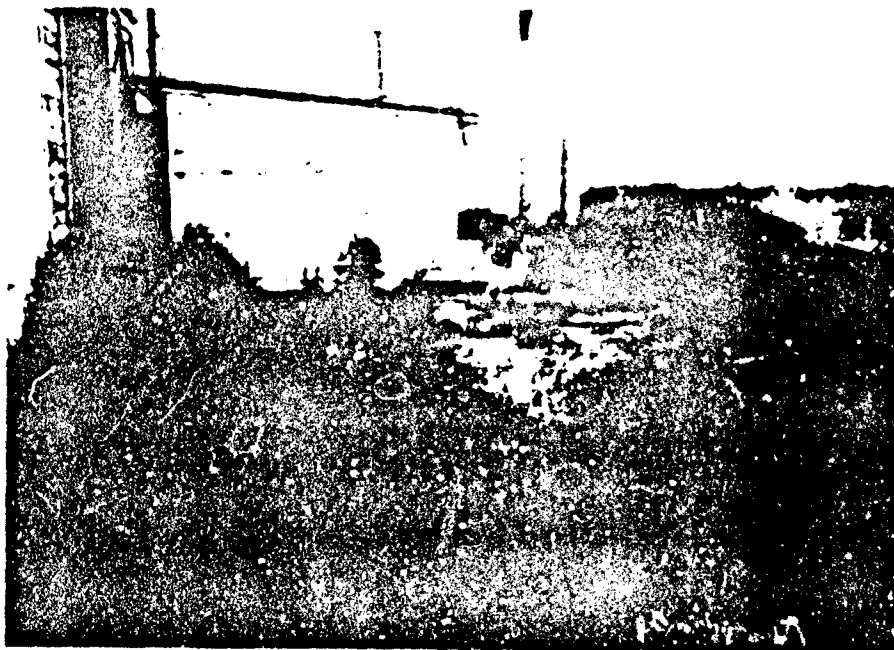
30. Pit/trench from drainage ditch outflow, outside CAMDS.



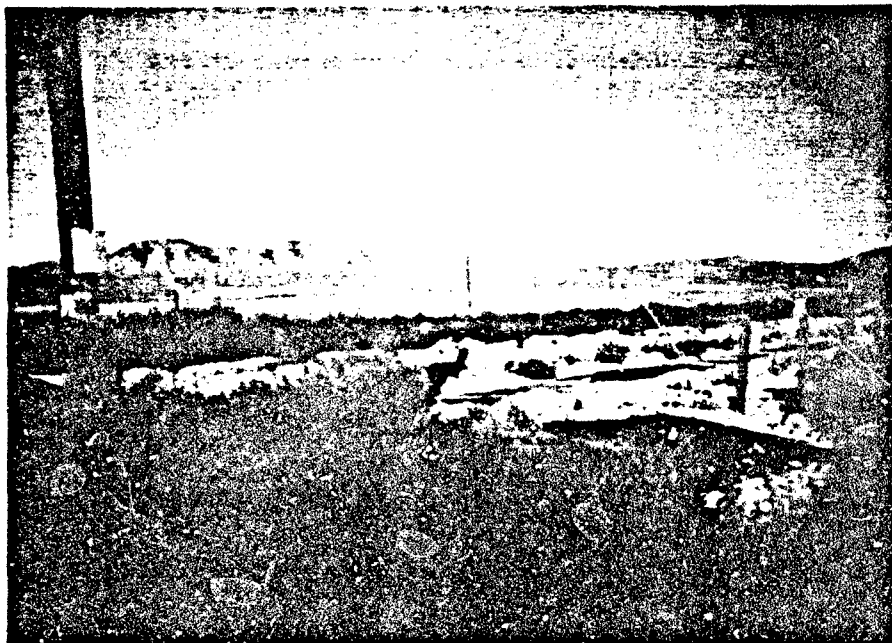
31. Mercury spill area by former deactivation furnace area. (Area on right side of photo is covered with hypalon type plastic.)



32. Mercury spill area by former deactivation furnace area.



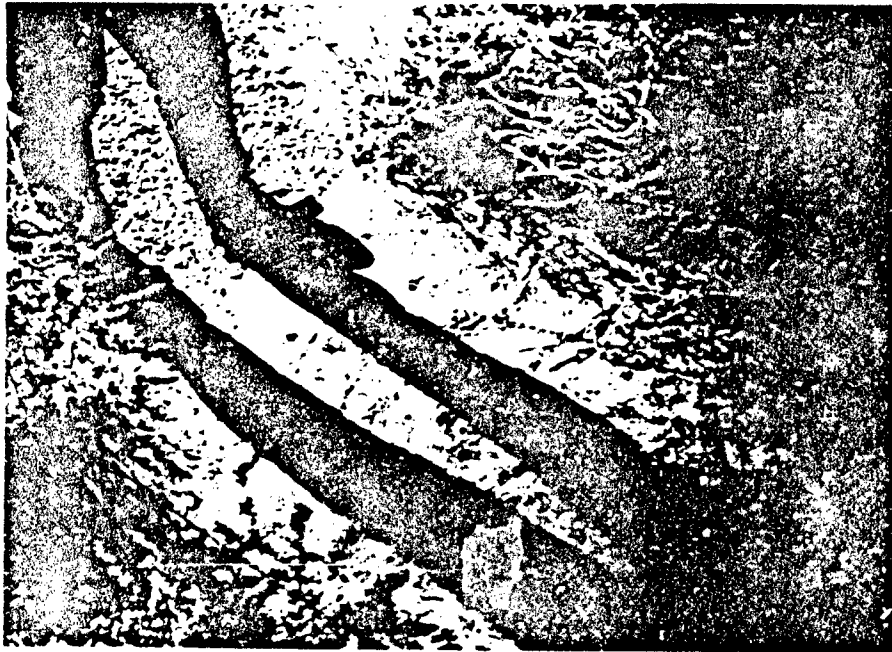
33. Mercury spill area by former deactivation furnace area.



34. Building 533 where  $\text{NO}_x$  and  $\text{SO}_x$  testing drums were previously stored, adjacent to mercury spill by former deactivation furnace area.



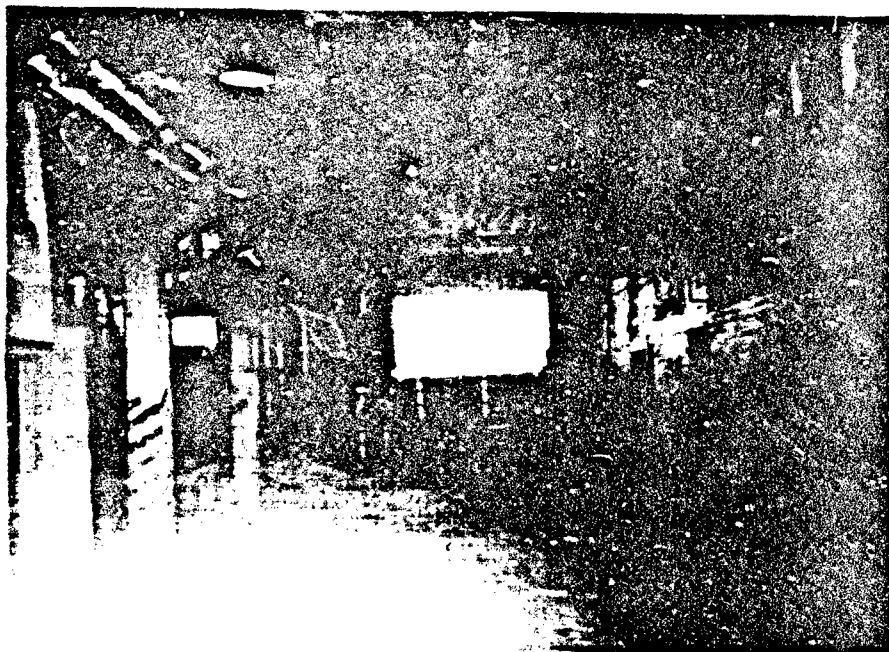
35. Tar like material on ground near Building 533 along NE/N edge of storage building. Note white fibrous material in tar, adjacent to mercury spill by former deactivation furnace area.



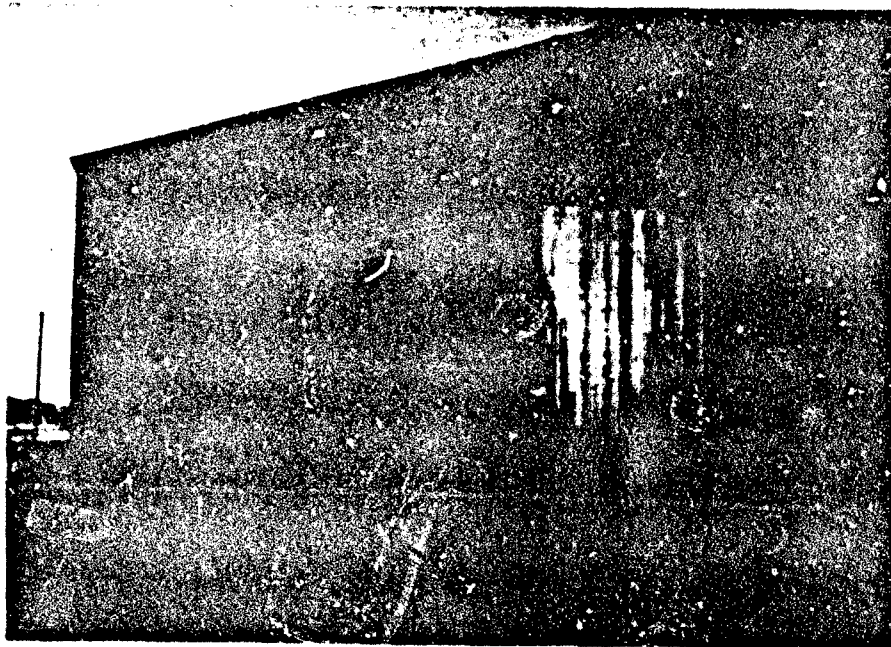
36. Warning sign near entrance to hazardous drum storage area near former deactivation furnace area, adjacent to mercury spill area.



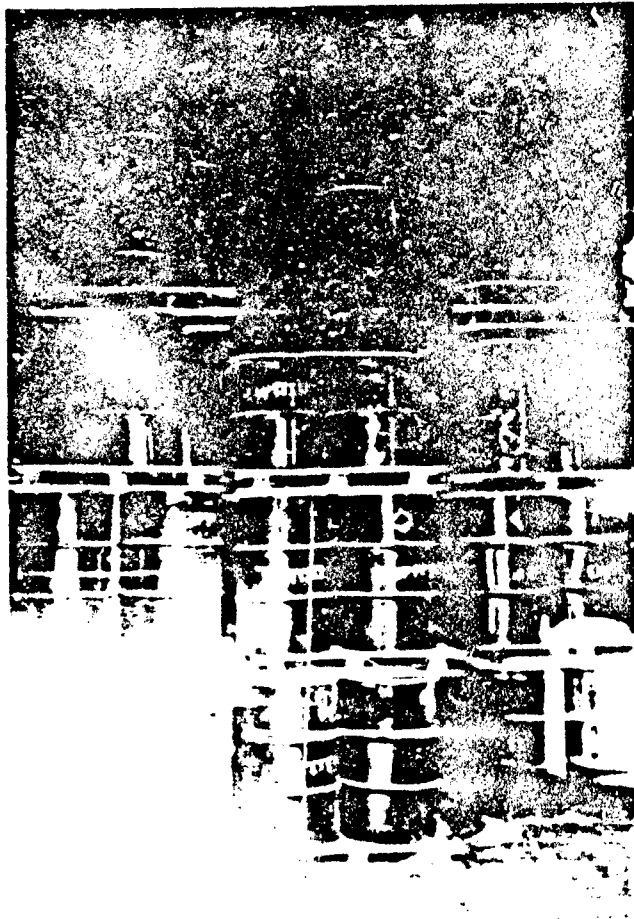
37. Drum storage inside building near former deactivation furnace area, adjacent to mercury spill area.



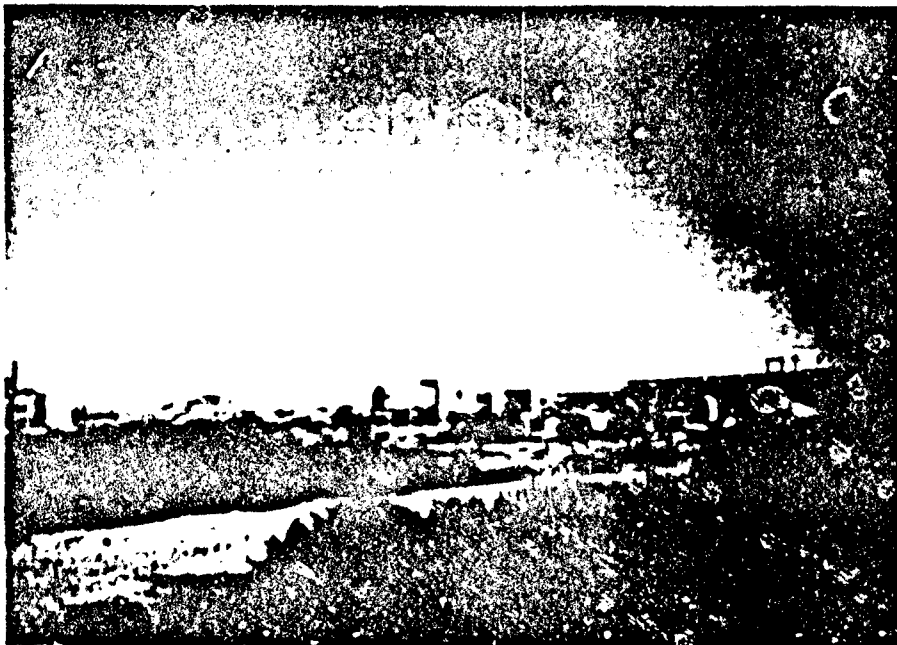
38. Another storage building east of former deactivation furnace area, adjacent to mercury spill area.



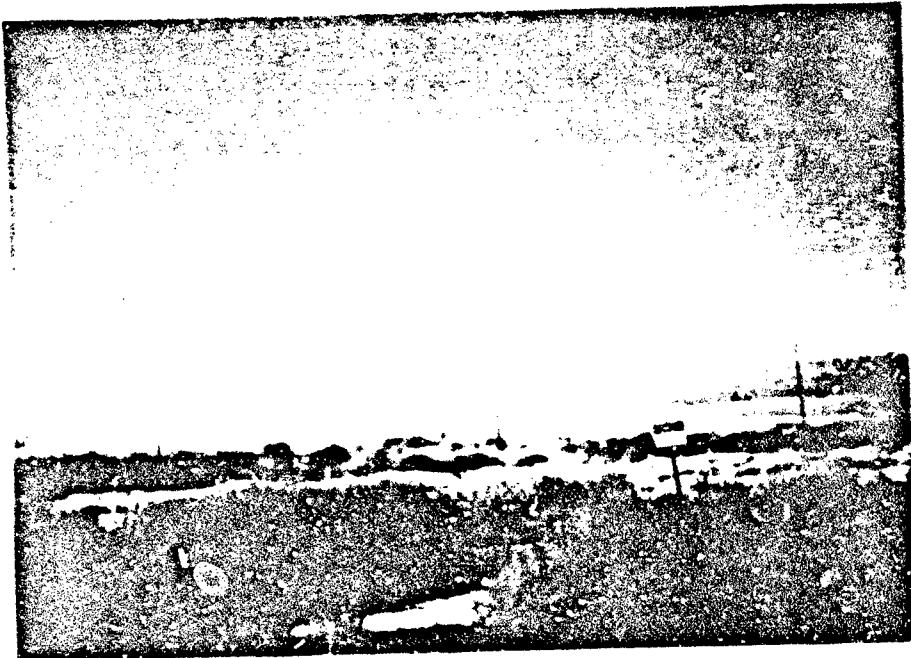
39. Drum storage inside Building 533 near former deactivation furnace area, adjacent to mercury spill area.



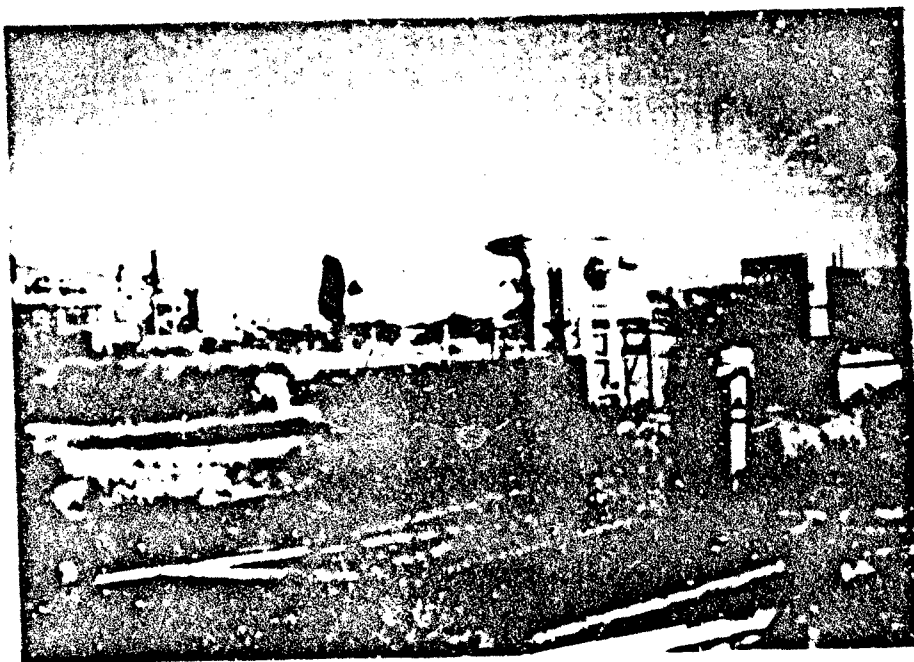
40. Former deactivation furnace (dismantled).



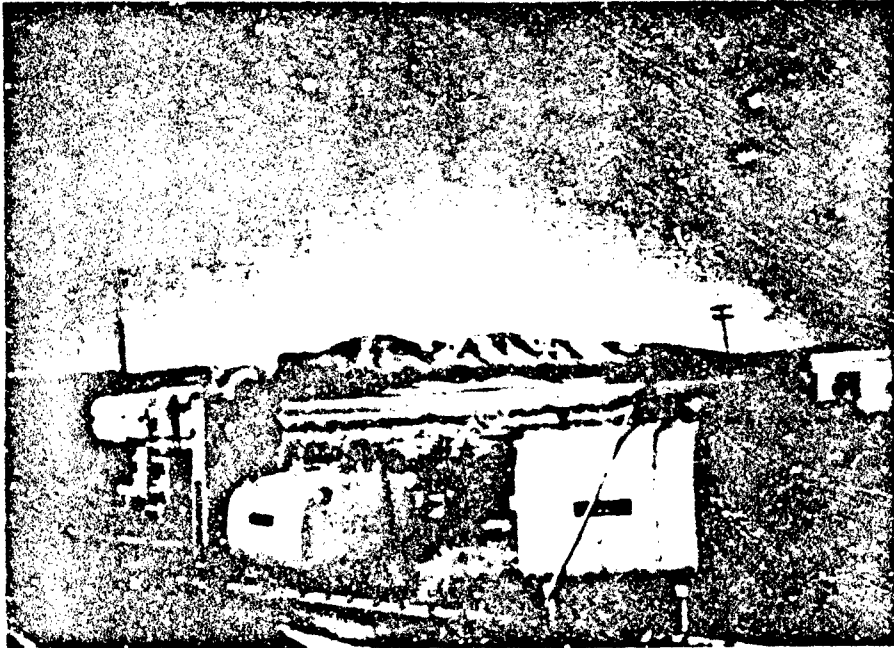
- 41 Areas along road near mercury spill in foreground is location of possible diesel fuel spill, adjacent to former deactivation furnace.



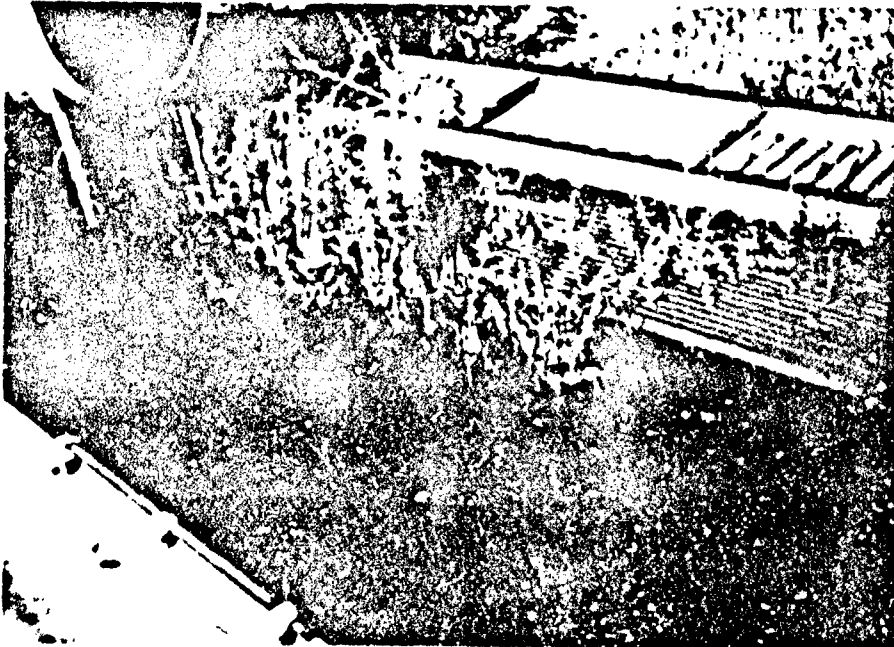
- 42 Former deactivation furnace parts.



- 43 Two yellow aboveground tanks by former deactivation furnace area; one leaked diesel fuel oil.



- 44 Diesel fuel spill area by aboveground tanks (soil area is in shadow), at former deactivation furnace.



R. GATHAMA AB7

LEACH FIELD

"OLD" OPEN SEWAGE  
LAGOON (1987)

CHEMICAL STORAGE AREA

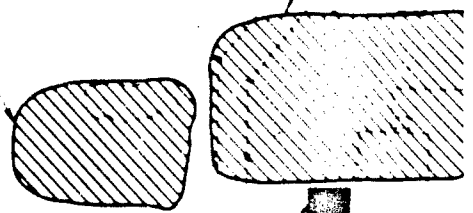
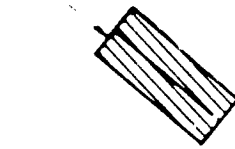
ABOVEGROUND RAW MATERIAL  
TANKS

ABOVEGROUND OIL TANKS

BOILER BLOWDOWN  
DISCHARGE POINT

DIESEL FUEL  
SEEP

DITCH



D. LEACH  
F. E. N.

PETROLEUM JST

DIESEL JST

LESS THAN 90 DAY STORAGE

TOXIC DUNNAGE INCINERATOR

DEACTIVATION FURNACE

METAL PARTS FURNACE

AIR POLLUTION ABATEMENT SYSTEM

LIQUID INCINERATOR

DDAY STORAGE

IE NO NERATOR

FURNACE

FURNACE

ABATEMENT SYSTEM

ERATOR

LEGEND



SOLID WASTE MANAGEMENT  
UNIT.



AREAS OF CONCERN

**Donohue**

Engineers & Architects

**S WASTE MANAGEMENT UNIT  
1 TOOEE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH**

Scale  
Date  
Designer  
Draftsman  
Checker  
Approver

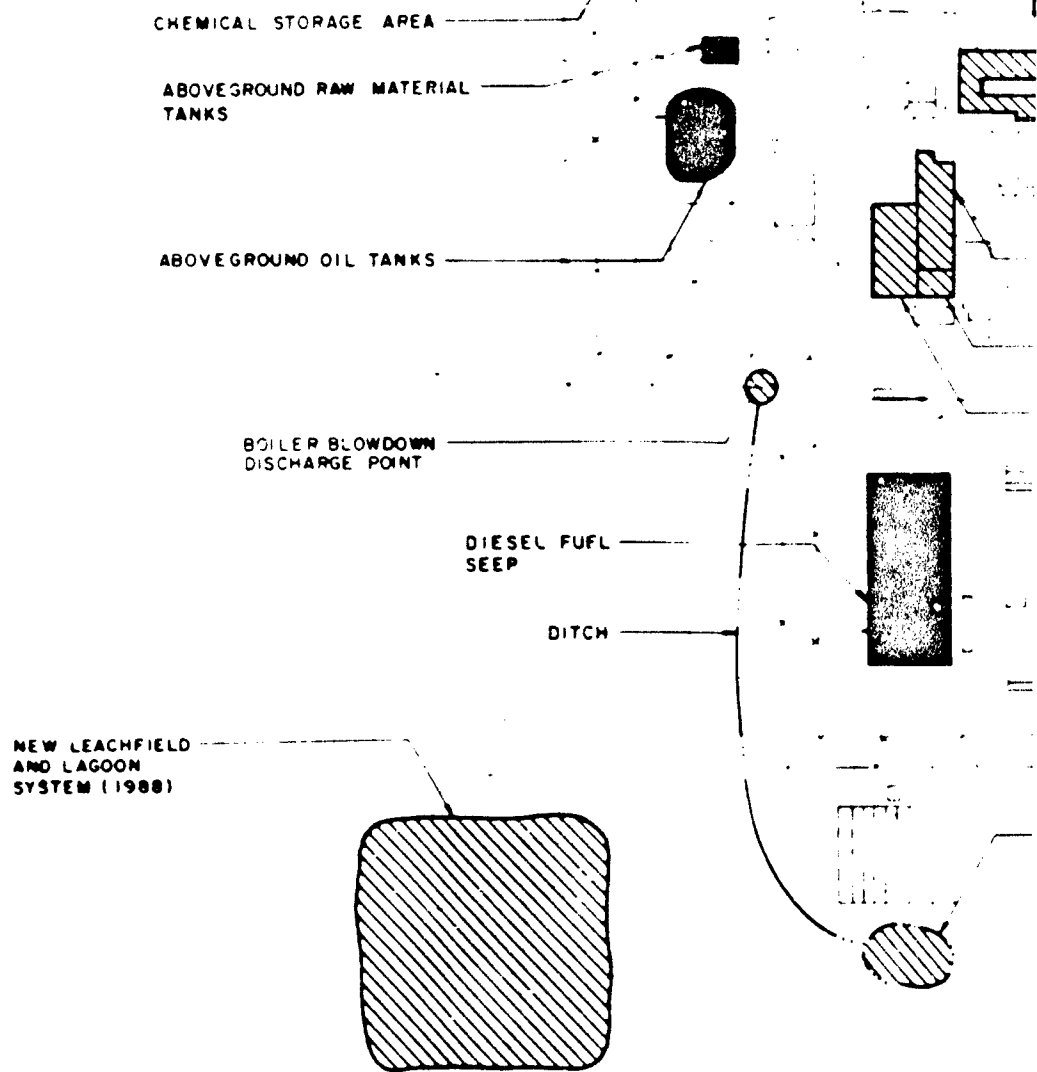
AS SHOWN  
OCT, 1989  
V.A.H.  
N.J.T.  
J.G.  
J.G.

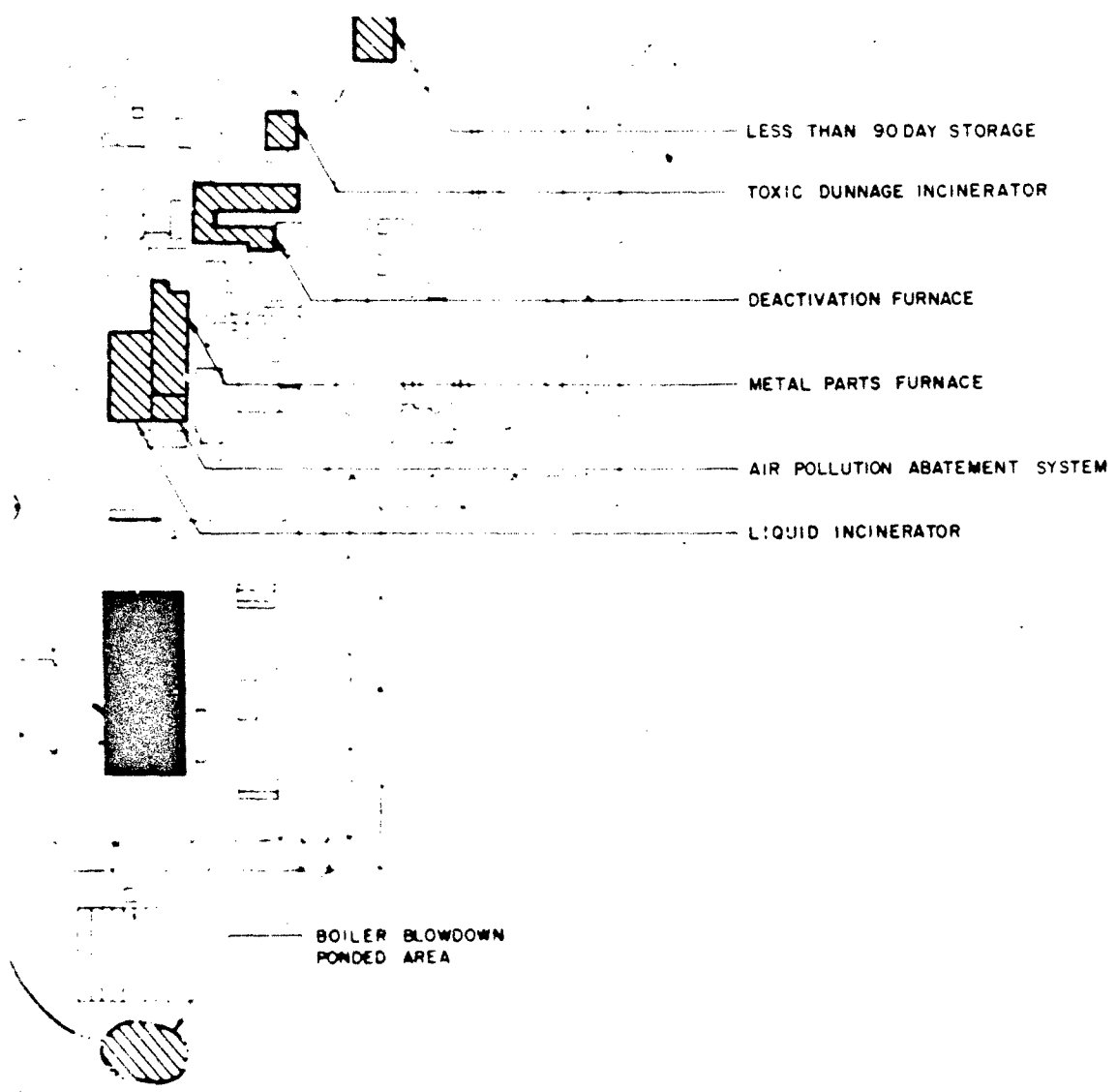
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Revision

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Date





90 DAY STORAGE

WASTE INCINERATOR

ON FURNACE

'S FURNACE

ON ABATEMENT SYSTEM

INERATOR

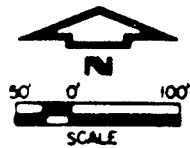
LEGEND



SOLID WASTE MANAGEMENT  
UNIT



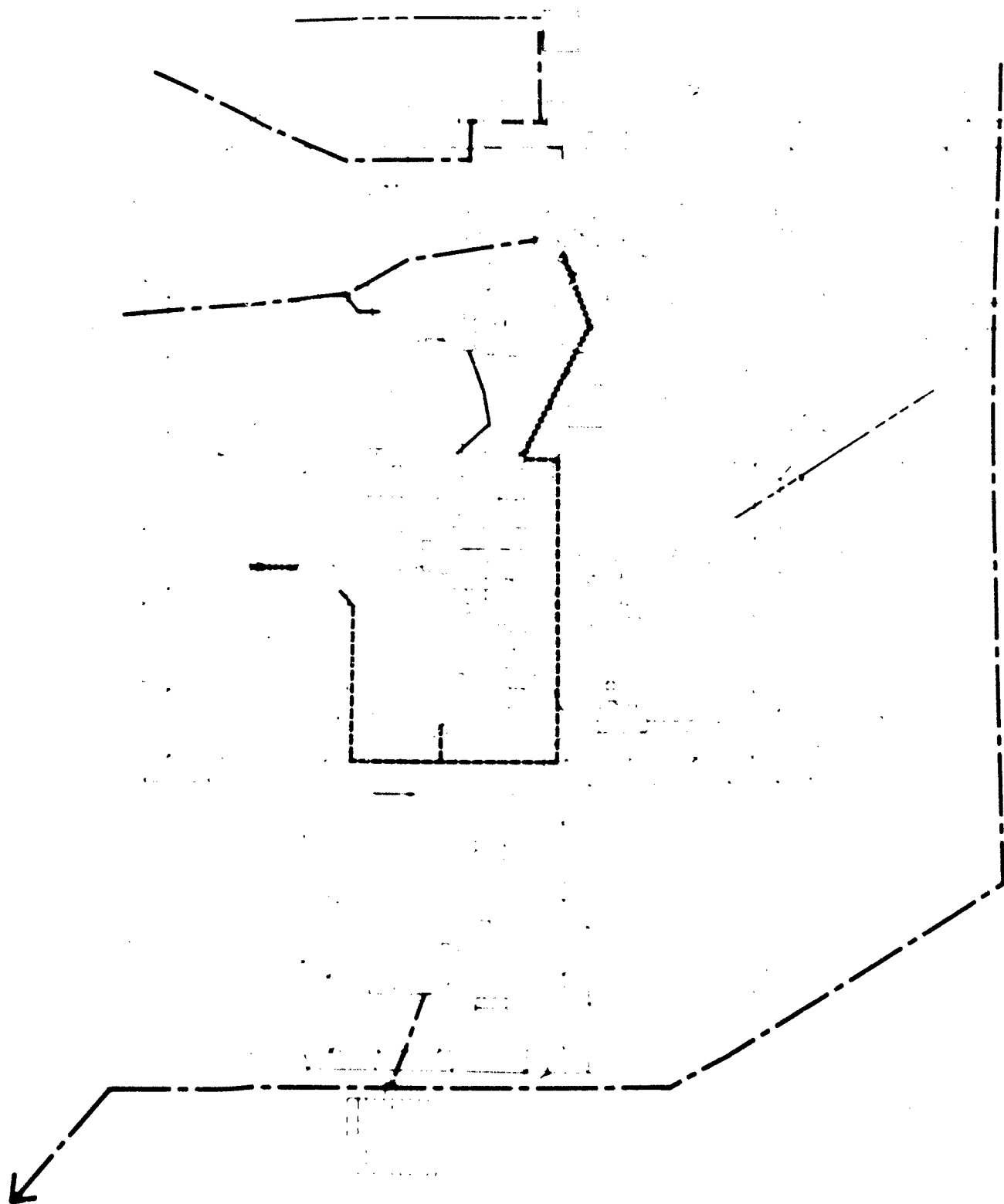
AREAS OF CONCERN



SCALE IS APPROXIMATE

**CAMDS WASTE MANAGEMENT UNIT**  
**SOUTH TOOELE RCRA SUMMARY REPORT**  
**TOOELE ARMY DEPOT**  
**TOOELE, UTAH**

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LEGEND	
-----	SEWER LINE
—————	HOT WASTE LINE
-----	FUEL OIL
=====	DRAINAGE LINE
-----	ABANDONED FUEL OIL LINE

**FUEL AND SEWER LINES AT CAMDS**  
 14TH TOOELE RCRA SUMMARY REPORT  
 TOOELE ARMY DEPOT  
 TOOELE, UTAH

**Donohue**  
 Engineers & Architects

Scale	AS SHOWN	Revisions	By	Date
Date	OCT, 1989			
Designer	V.A.H.			
Drafter	N.J.T.			
Checker	J.G.			
Approver	J.G.			
	No			

**WASTE, FUEL AND SEWER LINES AT CAMDS**

**SOUTH TOOELE RCRA SUMMARY REPORT**

**TOOELE ARMY DEPOT**

**TOOELE, UTAH**

**LEGEND**



SEWER LINE



HOT WASTE LINE



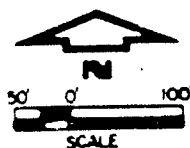
FUEL OIL



DRAINAGE LINE



ABANDONED FUEL OIL LINE



SCALE IS APPROXIMATE

17203

4-2

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# LEGEND

- WASTE TANK LOCATIONS  
BELOW GRADE & UNDERGROUND
- 7A TANK DESIGNATION

NOTE  
REFER TO TABLE 4-4 FOR TANK DESCRIPTION

**Donohue**

## GROUND AND BELOW GRADE WASTE TANKS

UTH TOOEELE RCRA SUMMARY REPORT  
TOOEELE ARMY DEPOT  
TOOEELE, UTAH

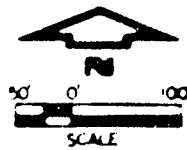
Engineers & Architects

Size	Date	Designer	Drawer	Checker	Approver	No.	Revision	By	Date
AS SHOWN	OCT. 1989	V.A.H.	N.J.T.	J.G.	J.G.				

LEGEND

- WASTE TANK LOCATIONS  
BELOW GRADE & UNDERGROUND
- \*A TANK DESIGNATION

NOTE  
REFER TO TABLE 4-4 FOR TANK DESCRIPTION



SCALE IS APPROXIMATE

**UNDERGROUND AND BELOW GRADE WASTE TANKS**

**SOUTH TOOELE RCRA SUMMARY REPORT  
TOOELE ARMY DEPOT  
TOOELE, UTAH**

17263

4-3

NEW WELL

EW WELL

S-28-88

S-25-88

S-27-88

S-30-88

S-29-88

CAM 8

DC

5.00 00

CAM 10



LEGEND

WESTON WELL

ENTERED WELL

NEW WELL

UNDWATER MONITORING WELLS  
AT CAMDS FACILITY  
WITH TOOEE RCRA SUMMARY REPORT  
TOOEE ARMY DEPOT  
TOOEE, UTAH

Dorohue

Engineers & Architects


Scale	AS SHOWN
Date	OCT. 1989
Designer	V A H
Drafter	N J T
Checker	J G
Approver	J G

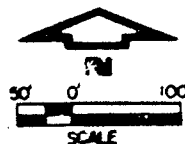
NEW WELL LOCATIONS	1	90
By		0.00

# GROUNDWATER MONITORING WELLS AT CAMDS FACILITY

SOUTH TOWNE RCRA SUMMARY REPORT  
TOWNE ARMY DEPOT  
TOWNE, UTAH

## LEGEND

S-00-00 WESTON WELL  
CAM - 0 ERTEC WELL  
 NEW WELL



SCALE IS APPROXIMATE

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Date	
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